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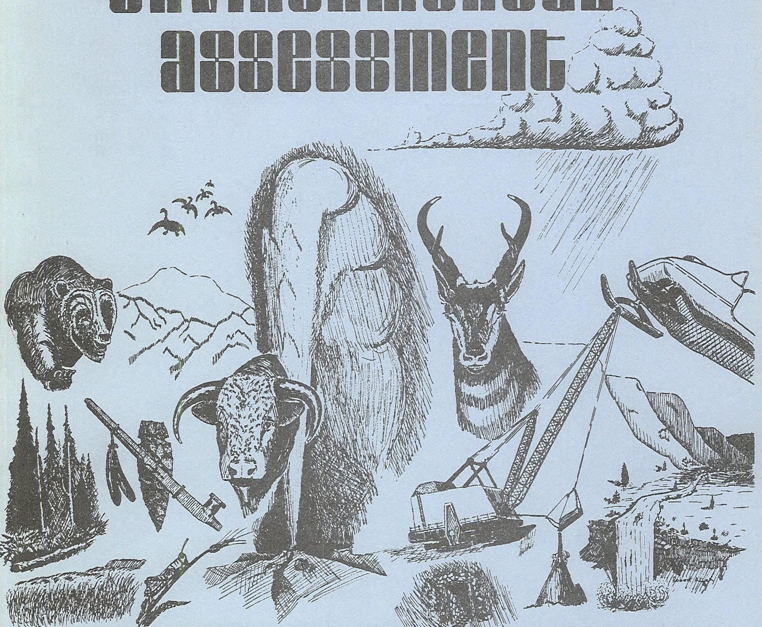

final
environmental assessment record

TIMBER MANAGEMENT PLAN
DILLON SUSTAINED YIELD UNIT

butte district montana

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

MT-070-68-7-10

ENVIRONMENTAL ASSESSMENT

FINAL

DILLON SUSTAINED YIELD UNIT

TIMBER MANAGEMENT PLAN

September 1977

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BUTTE DISTRICT

U.S. Department of the Interior - Bureau of Land Management

ENVIRONMENTAL ASSESSMENT RECORD
DILLON SUSTAINED YIELD UNIT TIMBER MANAGEMENT PLAN

TABLE OF CONTENTS

INTRODUCTION

Evolving from an era of common use of public timber, many restraints have been placed upon the harvesting of timber from Public Lands (PL) of the Bureau of Land Management (BLM). In addition to the legal authority for disposing of timber set forth in the Materials Sales Act of 1947 (amended 1955 and 1962), there has been legislation which either directly or indirectly affected the practice of harvesting public timber. There is, to name a few, the Classification and Multiple-Use Act of 1964, the National Historic Preservation Act of 1966, the National Environmental Policy Act of 1969, and the Federal Water Pollution Control Act PL 92-500, 1972, and the Federal Land Policy and Management Act PL 94-579, 1976.

Timber harvesting from PL is further controlled by the Bureau's own planning system through inventory and information gathering phase, decision making phase, and the Allowable Cut Planning System.

Out of a composite of all the above mentioned forces emerge those lands environmentally and economically suitable for the continuous production of timber and an allowable cut for these lands.

The National Environmental Policy Act of 1969 directs all agencies to prepare a detailed environmental statement of all actions significantly affecting the quality of the human environment.

The total timber management program of the BLM was judged to have significant environmental impact. A draft Environmental Impact Statement for the Bureau's Timber Management Program was released in January 1975 for public review. A final EIS was issued in September 1976. Prior to the issuance of the final EIS, the Bureau became involved in a suit with the Natural Resources Defense Council (NRDC) concerning the Bureau's Timber Management Program. An agreement was reached with the NRDC which specified that (1) EISs are to be written on the timber management plans for all Sustained Yield Units (SYU) in western Oregon, and (2) decisions

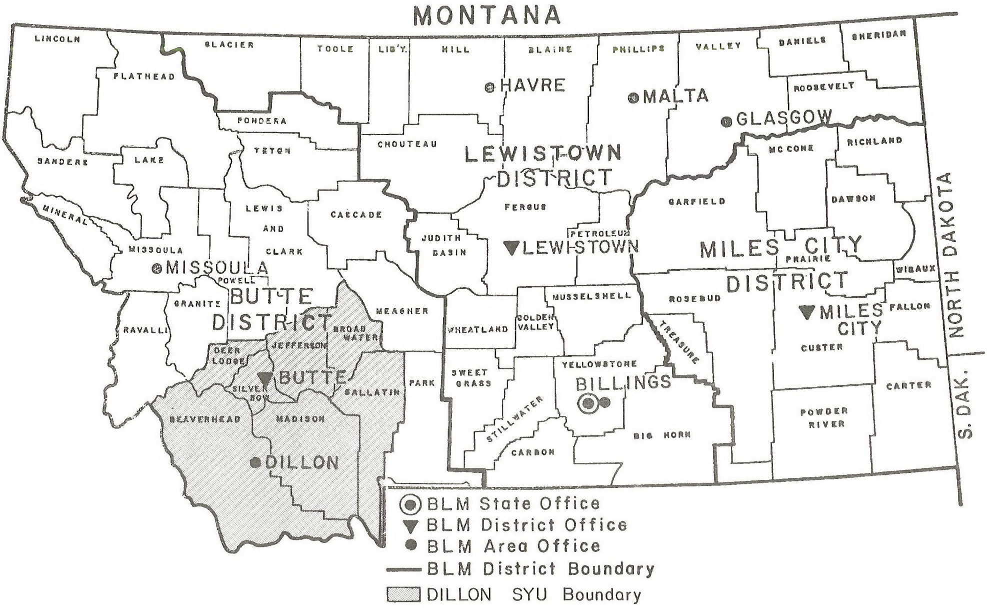
for the need of EISs on the timber management plans for sustained yield units outside of western Oregon will be made on the merits of each case.

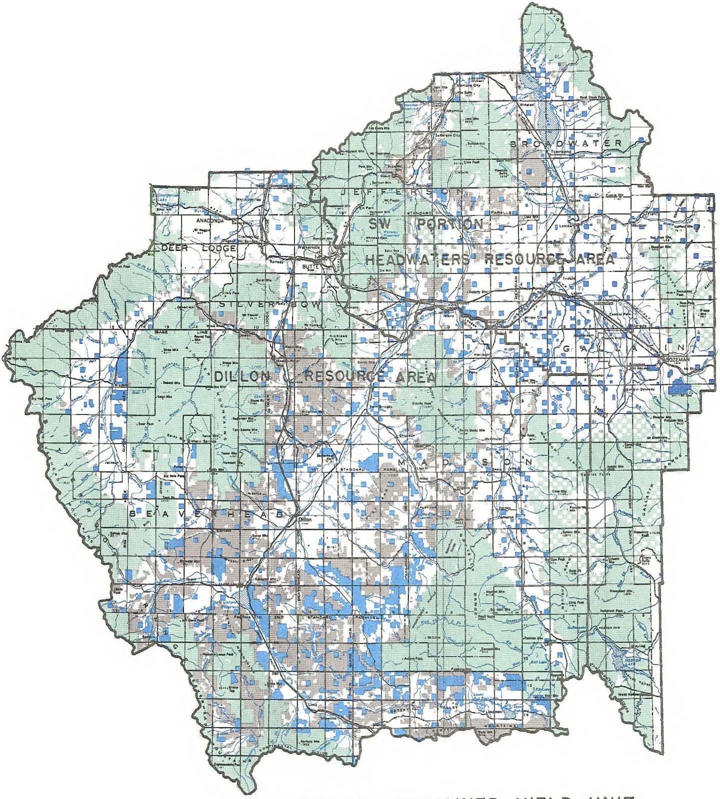
The purpose of this Environmental Assessment Record (EAR), then, is: TO DETERMINE IF THE TIMBER MANAGEMENT PLAN FOR THE DILLON SUSTAINED YIELD UNIT (SYU) IS A MAJOR FEDERAL ACTION CAUSING SIGNIFICANT ENVIRONMENTAL IMPACTS OR HAVING A HIGH INTENSITY OF PUBLIC INTEREST, THEREBY REQUIRING AN ENVIRONMENTAL IMPACT STATEMENT. If an EIS is not necessary, the action will proceed based on the EAR.

The Dillon Sustained Yield Unit includes National Resource Lands in Jefferson, Broadwater, Deer Lodge, Silver Bow, Beaverhead, Madison, and Gallatin Counties. The Timber Management Plan includes the allowable cut planning system and timber activity plans that deal with the implementation of the allowable cut.

This program assessment of the Timber Management Plan includes the application of silvicultural practices that would be used to implement the program, and the effects that can be expected from this program on the environment in and around the Dillon SYU.

A program type of analysis is not meant to preclude detailed analysis of silvicultural actions on a site specific basis. A site specific plan (called a compartment development plan) will be prepared prior to a timber sale in an area. An environmental assessment will be prepared for each compartment development plan. It may be that, because of unique impacts or an unusual degree of public interest, an environmental impact statement will be prepared for a specific timber sale or compartment development plan.


MONTANA
LINCOLN
GLACIER
TOOLE
LIB'Y.
HILL
BLAINE
PHILLIPS
VALLEY
DANIELS
SHERIDAN
FLATHEAD
HAVRE
MALTA
ROOSEVELT
GLASGOW
PONDERA
TETON
CHOUTEAU
LEWISTOWN
DISTRICT
MC CONE
RICHLAND
SANDERS
LAKE
MINERAL
LEWIS
AND
CLARK
CASCADE
FERGUS
GARFIELD
DAWSON
JUDITH
BASIN
PETROLEUM
LEWISTOWN
MILES CITY
PRAIRIE
MISSOULA
MISSOULA
POWELL
DISTRICT
WIBAUX
NORTH DAKOTA
BUTTE
DISTRICT
GRANITE
MEAGHER
MUSSELSHELL
ROSEBUD
MILES
CITY
FALLON
RAVALLI
BROAD
WATER
JEFFERSON
WHEATLAND
GOLDEN
VALLEY
TREASURE
CUSTER
DEER
LODGE
BUTTE
SILVER
BOW
GALLATIN
PARK
SWEET
GRASS
YELLOWSTONE
BILLINGS
CARTER
BEAVERHEAD
MADISON
STILLWATER
BIG HORN
POWDER
RIVER
S. DAK.
DILLON
CARBON
BLM State Office
BLM District Office
BLM Area Office
BLM District Boundary
DILLON SYU Boundary



DILLON SUSTAINED YIELD UNIT
BUTTE DISTRICT, MONTANA

Lands Administered By Bureau Of Land Management
Lands Administered By Forest Service
Lands Administered By State

SUMMARY

A total of 1,248,000 acres of Public Lands (PL) are included in the Dillon Sustained Yield Unit (SYU). Approximately 171,733 acres of this (14%) are classified as commercial forest land. The BLM completed a multiple-use oriented evaluation of these lands in 1974. With information available at that time, it was determined a total of 99,010 acres were available on which to implement a 10-year multiple-use timber management program. Implementation of the proposed action over the 10-year period will have a direct effect on approximately 22percent (21,588 acres) of the commercial forest land.

The objective of the timber management plan is to produce a high level of wood products subject to the principles of multiple use, sustained yield, and environmental quality and protection. The 99,010 acres were restricted by an additional 18 percent reduction in potential yield in order to protect other resource values, such as recreation areas, streamside corridors, watershed protection, scenic corridors, and wildlife habitat.

Practices used to accomplish the proposed action are diverse, but those of major importance relate directly to the harvest of forest products (logging, road construction, and slash disposal). Over 94 percent of the final acreage harvesting will be by partial cutting, which requires harvesting in stages, with at least a 10-year period between each stage. This method allows essentially continuous canopy management in that the next stand of trees is regenerated prior to complete removal of the overstory. Precommercial and commercial thinnings prescribe cutting of immature and small diameter mature trees to concentrate growth on fewer trees to produce quality forest products. Control measures for insects and disease are also discussed and evaluated.

Unless proper forest management techniques are applied, the potential for adverse impacts is considerable. Drawing on research results, practical experience, and the direction provided by multiple-use oriented land use plans, a timber management plan has been proposed which reduces the impacts to what we consider an acceptable level. The plan has the flexibility to be responsive to changing conditions, new knowledge, technological developments, changing public attitudes, and national needs.

Beneficial impacts are both environmental and economic. More of the forest's natural productivity will be realized, and the products removed will meet public needs and help provide a living to residents of western Montana. This proposal involves a small portion of the commercial forest land in the counties involved within the SYU. This should be considered when evaluating both the significance of environmental and economic impacts.

Residual impacts will include some impacts on air, land, water, wildlife, and human values. Of the physical factors, impacts on land are the greatest. Most of the impacts in terms of soil erosion and loss of productivity relate to road building. Impacts on the aesthetics of areas under management are among the most important of the human values. Changing land uses on adjacent lands will impact and be impacted by the proposed action. It is difficult to predict future private land uses, but the trend of land use changes (towards homes, cabins, recreation, etc.) and the growth of these uses tend to increase impacts of and on timber management. Effects on long term productivity and commitment of resources are minor. The loss of productivity on the acreage used for roads will be offset by the maximizing of productivity potential through intensive forest management practices consistent with environmental protection. Changes in vegetation and the presence of man will affect animals, in terms of habitat, population, and behavior.

Public interest in program level determinations of forest practices has been evidenced during meetings held on land use planning. People have a tendency to become much more interested in individual timber sales or small areas within the SYU where they make use of PL and are more familiar with the environment. Thus, the intensity of interest in individual actions taken under this proposal will probably generate more interest than the overall action. Public involvement in these actions will be required for their successful implementation.

Public open house sessions were held in the Butte and Dillon offices both of which generated some interest. All who attended had some specific interest in the lands, such as posts and poles, sales, off-road vehicle use, or sawlog harvesting.

The analysis points up the importance of preparing compartment development plans within the SYU in conjunction with individual timber sales. Certain small sales will not normally be covered by these compartment plans. Each of the proposed actions will be accomplished by environmental assessments which will supplement this document.

CHAPTER 1

PROPOSED ACTION

The proposal is a timber management program commensurate with multiple use and environmental considerations using intensive management practices. The forests throughout western Montana play a major role in the areas' development and economic well-being. The Dillon Sustained Yield Unit (SYU) includes forested Public Lands (PU) in Beaverhead, Deer Lodge, Madison, Silverbow, Jefferson, Broadwater, and Gallatin Counties. It is an area of broad economic diversity with agriculture, recreation, mining, and, to a more limited extent, wood products, playing major roles. The traditional use of BLM administered lands in the Dillon SYU was directed at grazing and minerals with timber, recreation, and other uses playing lesser roles. Within the past 10 years, public demands have changed and the BLM has switched from custodial to retentive and multiple use oriented management.

Timber sale offerings from the Dillon SYU have been sporadic as indicated on Table I, page 1-3.

Average yearly harvest from 1951 through 1975 has been 1.23 million board feet (MM bd. ft.). From 1970 through 1975, a lack of funding, manpower, and support needs such as access and inventory, and a rechanneling of effort from timber production to inventory and planning have reduced harvest levels to an average of 300,000 bd. ft. per year.

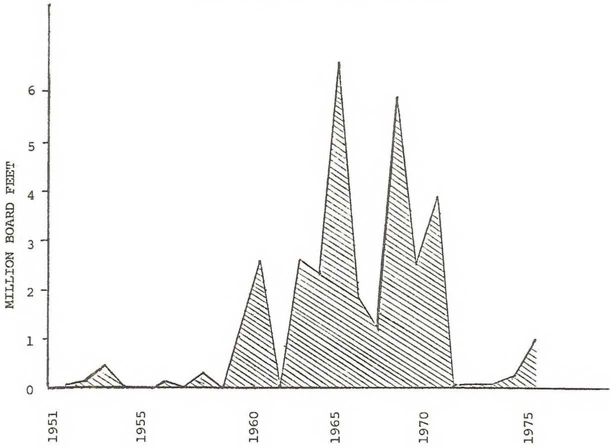
The primary objective of the timber management program in the Dillon SYU is to produce the maximum amount of raw material from selected commercial forest lands classified as available for timber production <u>subject to the principles of multiple use, sustained yield, and environmental quality</u>. The proposed allowable cut for the SYU is 54.6 MM bd. ft./decade, an average of 5.46 mm bd. ft./year - scribner log rule. The level of yield is influenced by the ability of the forest to respond to

cultural and management practices aimed at increasing natural forest productive capacity. Of the proposed harvest of 54.6 MM bd. ft./decade, 46.24 MM bd. ft. or 85 percent is attributed to natural growth, while 8.36 MM bd. ft. or 15 percent is due to intensive management. To produce this volume, approximately 15,508 acres will be selectively cut, 1,400 acres clear cut, and 4,680 acres commercially thinned, (based on a computerized forest management model). The timber management program would be implemented in five generalized stages. These states are (1) inventories and planning, (2) harvest, (3) slash disposal, (4) development, and (5) protection.

In preparing this material, the Butte District has consulted the Montana State Office and Washington, DC Office of the BLM concerning policy and alternative selection. The guidelines contained in the forestry program activity policy statement (BLM Manual 1603) and other directives indicate that BLM lands in Montana are to be managed for maximum yield, commensurate with multiple use and environmental considerations, using intensive forest management practices which are environmentally and economically feasible.

TABLE I

HISTORY OF TIMBER HARVEST-DILLON SYU
(Volume removed by calendar year)



INVENTORIES AND PLANNING

The determination of a forest's potential for wood fiber production is done in two phases. These are referred to as the (1) Extensive Inventory and Land Use Plan, and (2) Intensive Inventory and Compartment Development Plan.

The annual Timber Sale Plan is made up from a combination of these two planning phases:

1. Extensive: An evaluation of the land under study (Sustained Yield Unit) on a broad scale including old inventory data, maps, land use and aerial photo interpretation; from this collection of information a statistical sampling procedure is set up. Individual photo points are closely evaluated and separated into strata according to criteria which, in the judgment of people familiar with the forests of the inventory area, give a good sample of potential productive forest lands. In the Dillon SYU, tree height and stand density were major evaluation criteria.

These stratified sample points are statistically evaluated and approximately 10 percent are randomly selected for careful evaluation on the ground. For the Dillon SYU, approximately 200 plots were installed in forest types. This is a double sampling procedure consisting of (a) photo interpretation and (b) field plot installation. From this we have the information necessary to determine potential allowable cut.

In the Land Use Planning Phase, the results of the field study are tempered by policy, environmental considerations, and multiple use trade-offs. (See Timber Management Plan for the Dillon Sustained Yield Unit, Appendix II of this EAR.) This results in a generalized zoning of the planning unit which identifies portions of the commercial forest land base which are available for intensive timber

production, portions of the commercial land base on which management practices must be tempered because of environmental or multiple use considerations, and portions of the commercial forest land base which are not available fot timber production because of the same considerations. This process incorporates all the recommendations of land use plans into the Timber Management Plan.

In the Timber Management Plan, technical data from the extensive forest inventory is used to determine the level of harvest that will provide the maximum sustained yield of forest products consistent with the multiple use guidelines contained in our land use plans. The allowable cut computation includes those intensive management practices needed to sustain the levels of harvest during the next decade. Only intensive management practices which are technically and economically feasible and meet environmental standards are considered.

2. Intensive: Following the extensive inventory, we know how much is available for management, but we do not know where, on a site specific basis, it is located. The intensive inventory gives us this information in the form of in-place stand condition, age, volume, growth rates, site classes, and habitat types. On the Dillon SYU, this will be done with site specific inventories in conjunction with and including compartment development plans on which entire drainages or acres of PL will be evaluated from a total management standpoint including, but not limited to, access, wildlife use, water quality, stand prescriptions, and physical and social restrictions.

The compartment plan will evaluate impacts of the proposed silvicultural prescriptions for each identified stand within the compartment area.

We are now ready to incorporate this information into a Timber Sale Plan on a yearly basis. Stated simply, the plan identifies those tracts included in the timber production land base which, considering options,

have a priority for harvest. The implementation of the Timber Sale Plan is described as follows:

> Plan formulation is on a fiscal year basis. The proposed sale plan is exposed for public comment both by dissemination to interested parties and various segments of the public, for any possible coordination needed with planned activities of other agencies or landowners.

An environmental analysis will be made on each compartment plan proposed for inclusion in the Timber Sale Plan in the form of an Environmental Assessment Record (EAR) or, if necessary, an Environmental Impact Statement (EIS). After a decision is made on which stands to harvest, those with the highest priority are then prepared for sale.

The design of these particular tracts, including such items as size, road location, logging systems, whether or not buffer strips are left, etc., is guided by land use plans and the environmental assessment. Sale layout is a crucial step in seeing that the intent of the planning is carried out in the individual on-the-ground application of management decisions.

There are certain small sales of forest products which will not normally be covered by compartment plans. These are small sawlog sales of 50,000 board feet or less such as house log sales, small salvage sales, or small commercial thinning sales. Other sales not always covered by compartment plans are post and pole sales sold on a public demand basis and salvage sales of insect, weather, or fire killed timber of less than 250,000 board feet. These sales will, however, be covered by an Environmental Assessment Record and checklist of contract stipulations which conform with recommendations of a multi-discipline team of resource specialists.

At this point in the process, the individual timber sale is advertised. This begins the cycle of harvest, regeneration of new stand, cultural measures applied to the new stand, and protection of the new stand until such time as the stand again undergoes a harvest cut. The management practices used in this cycle and their respective environmental impacts are described in the remainder of this document.

HARVEST

The harvest cutting operation is the final phase of the timber growing cycle and the first phase of the utilization cycle which represents the conversion of standing trees into wood products. The steps associated with the harvest phase include (1) the cutting of trees according to the <u>silvicultural system</u> prescribed for each designated harvest area, (2) the movement of logs or trees from stump to loading points by use of <u>yarding systems</u>, and (3) their subsequent movement over <u>transportation systems</u> to the manufacturing center.

Silvicultural systems are methods of forest manipulation designed to provide for harvesting, regenerating, and maintaining the desired species with a stand of suitable structure.

Selection of the appropriate cutting practice is basically a matter of management objectives; i.e., a certain system is applied to a given timber stand to favor regeneration of the desired species and/or promote growth or to avoid adverse environmental impacts. Factors weighed in selecting the silvicultural system include forest habitat types, species composition, stand age, stocking, condition (as related to tree vigor and risk of mortality), and environmental impacts. Once the silvicultural system is chosen, those trees designated for cutting and/or trees reserved from cutting are identified on the timber harvest area.

The silvicultural systems discussed in this section are (1) SELECTION, (2) SHELTERWOOD, (3) SEED-TREE, and (4) CLEARCUTTING. These terms also refer to the method of harvest cutting that characterizes each system, but it is important to think in terms of a system of silviculture rather than only one method of harvest cutting.

(1) The SELECTION system involves the removal of individual trees or groups of trees at periodic intervals. Regeneration is established almost continuously. The objective is maintenance of an uneven ages stand, with trees of different ages or sizes intermingled singly or in groups. This system is aesthetically pleasing, but is difficult to apply successfully unless the stand structure is favorable. Economically, this system is more expensive because more stand entrys are required and lower volumes/acre are removed. The two types of selection are uniform or individual tree selection and group selection.

Individual (single) tree selection involves the removal of individual trees (rather than groups of trees). In mixed stands, it leads to an increase in the proportion of shade-tolerant species in the forest.

INDIVIDUAL TREE SELECTION
(Figure 1)

BEFORE AFTER

Group selection can be used to maintain a higher proportion of the less shade-tolerant species in a mixture than individual tree selection. For this purpose, larger harvest groups are more effective than smaller ones. In some stands, groups a fraction of an acre in size are generally suitable. In others, the groups may be as large as one acre.

When groups are of maximum size, they resemble small clearcut patches. The group selection system is distinguished from clearcutting in that the intent of group selection is ultimately to create a balance of age or size classes in intimate mixture or in a mosaic of small continguous groups throughout the forest (see Figure 2).

GROUP SELECTION
(Figure 2)

(2) The SHELTERWOOD system involves the removal of the mature stand in a series of cuts. Regeneration of the new stand occurs under the cover of a partial forest canopy. A final harvest cut removes the shelterwood and permits the new stand to develop in the open as an even-aged stand.

This system provides a continuing cover of either large or small trees. It is especially adapted to species or sites where shelter is needed for the new reproduction, or where the shelterwood gives the desired regeneration an advantage over undesired competing vegetation (see Figure 3). Douglas fir and ponderose pine are two species which often meet this criteria on the SYU.

(3) The SEED-TREE system involves harvesting most of the timber on a selected area in one cut. A few of the better trees of the desired species are left well distributed over the area to reseed naturally. When feasible, the seed trees are harvested after regeneration is established.

SHELTERWOOD
(Figure 3)

Initial Cut   Intermediate Cut   Final Cut

(4) CLEARCUTTING is the harvesting in one cut of all trees on an area for the purpose of creating a new, even-aged stand. The area harvested may be a patch, stand, or strip large enough to be mapped or recorded as a separate age class in planning for sustained yield under area regulation. Regeneration is obtained through natural seeding, or through planting or direct seeding. This system requires careful design and location of cutting block boundaries. Cutting blocks will be designed as closely as possible to complement natural openings in the forest canopy and avoid geometric designs (see Figures 4 and 5). Maximum size of clearcut units will be 40 acres. The absence of reserved trees on the clearcut area facilitates site preparation and other area-wide cultural treatments. This system is a frequently used method of regenerating lodgepole pine.

The movement of felled timber from the stump to the loading point (landing) is accomplished through the use of a yarding system or combination of yarding systems best suited for the area to be harvested.

The various yarding systems used or having potential for use in this sustained yield unit are horses, tractors, jammers, self-loading trucks, mobile yarder-loaders, standing skylines, and running skylines.

FIGURE 4

Test cutting studies of geometric shaped logging units. These will be avoided in Dillon SYU.

FIGURE 5

Cutover area at center of photograph was designed to blend in with natural forest openings

Horse skidding is still used advantageously in some situations. On suitable terrain they are well adapted to skidding small logs such as those produced in commercial thinnings. Horses can be used on narrow skid trails with minimum damage to the residual stand. They are best suited to skidding small logs down slope on gradients under 40 percent, for maximum distances not exceeding 600 feet.

Tractor skidders are of two general types, crawler and wheel. The former has a metal track, while the latter is invariably mounted on rubber and is known as a rubber-tired skidder. Both types of skidders may be equipped with integral arches. These accessories suspend one end of the log or turn of logs, thus reducing drag. Both types of tractors are used most effectively for downhill skidding on slopes under 40 percent, and for maximum distances less than 1,500 feet. However, under optimum conditions, normal maximum skidding distance is approximately 900 feet. Uphill skidding for short distances is feasible on gentle slopes, particularly for the larger crawler tractors. Often tractors complement other systems. A combination sometimes used on sidehill settings is downhill tractor skidding of the upper part and uphill cable yarding of the lower part to the same roadside landing.

The Idaho jammer (often a jerry-built machine) employs a boom and engine-powered drums, containing wire-rope cable used for yarding. This machine has the capability of partially lifting one end of the log during skidding. The effective use of this machine is dependent on adequate harvest volumes per acre and volumes per log. It is often an uneconomical skidding machine in areas containing light volumes per acre or small individual log volumes. The jammer may be used for yarding logs for distances usually not exceeding 500 feet. On slopes too steep for tractor operation, the jammer's yarding capability can be useful with a system of contour roads spaced at slope distances of 600 feet or less.

The self-loading truck is commonly equipped with a short horizontal boom with fairlead and cable wound on a drum powered by takeoff from the truck engine. Under favorable conditions, such trucks can yard logs from locations within 100 feet of roadside.

Mobile yarder-loaders are employed in situations where neither high-lead nor tractor logging is practical. The mobile yarder-loader is particularly adapted to removing small total volumes of timber, to operating in stands of low volume per acre, or in small timber on steep terrain.

While there are several variations of mobile yarder-loaders, they have certain common characteristics:

- All are self-propelled, and can be driven from setting to setting (as opposed to most high-lead yarders).
- All are equipped with booms or spars which, when erected, provide lift for yarding. When lowered, the boom can be rigged for loading trucks, thus eliminating a separate loading machine.
- Most have drum facilities which permit being used in cable systems.

Some of these machines can yard logs to a reach of 1,000 feet. However, under optimum conditions, usual maximum yarding distance is about 500 feet. Since they operate on the high-lead principle, mobile yarder-loaders are most efficient when yarding uphill. These machines are well suited to logging commercial thinnings, and sanitation-salvage, shelterwood, and selection cuttings. A rather unique attribute is their capability of operating directly from an existing road, thus eliminating the necessity of clearing and excavating landings. As each small setting below the road is cleared of logs, which are merely piled or "decked" along the road shoulder, the machine is quickly moved a short distance along the road to its next setting.

Skylines are moving-cable systems which yard or swing logs suspended between a tail-spar and a head spar. The basic principle of movement is via suspension from wire-rope cables. Modern skyline systems are mobile and have lateral yarding capability. The new systems can be used for both uphill and downhill yarding. They may be used in partial cuts. Some are readily convertible to conventional high-lead operation, a feature which increases their utility. Modern skyline systems are of three general types: standing or fixed skylines, slacklines, and running skylines.

Smaller fixed skyline equipment with yarding capability of 1,500 to 2,000 feet is available. These machines and rigging are less costly and more flexible than the large skylines; they do have an advantage in these respects over the high-lead and tractor systems.

Slacklines ("live" skylines) commonly operate on a reach of 1,200 to 1,600 feet or more, have capabilities and applications comparable to those of the smaller fixed skyline systems.

The running skylines are the most recently developed of the skyline systems. They are becoming widely used in the northwestern United States, and are replacing standing skylines and high-lead systems in some applications. A past disadvantage of these systems has been a rather short span capability (reach) of about 1,000 feet. However, yarders with reaches exceeding 2,000 feet are now available. The running skyline is particularly well suited to yarding intermediate cuttings and harvest cuttings of a partial nature, where damage to trees left standing must be minimized. When properly equipped and utilized, running skylines may yard clearcuttings as effectively as the high-lead system.

It is not anticipated that cable logging systems will be utilized to any great extent in the near future on the Dillon SYU. The overall

small volumes per acre and relatively low quality timber make cable yarding as well as balloon and helicopter logging systems economically unfeasible for the most part.

Table II charts the relative characteristics from a high of A to a low of E of the yarding systems versus the desired characteristics in terms of physical, environmental, silvicultural, and economic criteria. Any such system of qualitative ratings is subjective and must be adjusted to reflect more specific equipment or yarding constraints.

Transportation in the context of timber management is required to move logs from the landing or loading site located in the cutting area to a market destination.

The principal transportation medium is the logging truck. Because of intermingled land ownership patterns, the development of road systems often requires cooperation with adjacent landowners to insure access to the local, state, and federal highways that lead to the manufacturing centers.

Roads used in the forest management program are usually built by the timber sale purchaser under terms of the sale contract to specifications determined by the BLM. The cost of construction and maintenance is usually carried by the timber resource and is provided for under the terms of the timber sale contract. In some cases, multiple use roads built with appropriated funds may be used for log hauling.

Road design varies with the amount and type of use. Road standards vary according to amount and frequency of use. Those roads constructed

specifically for implementing the timber management program will be limited to minimum standards necessary to accomplish management objectives. Road widths range from 10 to 14 feet in usable width, and clearings range from 20 to 50 feet depending on topography, vegetation, and road use.

Construction of roads involves the movement of soil from one location to another to create a usable surface for log hauling. The equipment most widely used in logging road construction is a crawler type tractor with dozer blade and ripper. Tractors can be attached to scrapers for excavation and short hauls; however, trucks or self-propelled scrapers are usually used when earth must be moved longer distances.

There are no plans for surfacing any of these roads except where soft spots occur. Cuts and fills of mainline roads will be seeded. All other roads will be scarified, seeded to grass or other vegetation, and blocked until needed again. Culverts and/or bridges will be installed on all roads requiring continuous maintenance. All abandoned or closed roads will be cross-drained to allow normal runoff of water before damaging erosional forces develop.

TABLE II

RELATIVE CHARACTERISTICS OF VARIOUS YARDING SYSTEMS

DESIRED CHARACTERISTICS	YARDING SYSTEM					
	IDAHO JAMMER	TRACTOR OR SKIDDER	STANDING SKYLINE SINGLE SPAN	STANDING SKYLINE MULTI-SPAN	RUNNING SKYLINE GRAPPLE YARDING	RUNNING SKYLINE CHOKER LOGGING
PHYSICAL CRITERIA						
Compatibility with Road & Bridge Restrictions						
Compatibility with Health & Safety Codes						
Compatibility with Timber Size						
Min. Sensitivity to Ground Profile	B	C	C	C	C	C
Min. Sensitivity to Soil Conditions	C	E	B	B	B	B
Min. Sensitivity to Atmospheric Conditions	B	B	B	B	B	B
Min. Dependence on Tie-Downs	C	A	D	D	C	C
ENVIRONMENTAL & SILVICULTURAL CIRITERIA						
Min. Access Road Density						
Capability to Yard Extended Distances	D	C	B/C	B	B/C	B/C
Suitability to Uphill Logging	A	D	A	E	A	A
Suitability for Downhill Logging	E	B/E	C/E	B	C	C
Land & Service Areas	A	C	C	C	A	A
Min. Soil & Water Disturbance & Soil Compact'n	C	E	B	B	B	B
Suitability for Partial Cuts	C	A	A/E	A	E	A
Suitability for Clear Cuts	A	A	A	A	A	A
Min. Impact on Fish, Wildlife & Range Habitat						
Suitability for Irregular Shapped Settings	D	B	B	C	B	B
Suitability for Clean Yarding	C	A	B/C	B	B	B
Min. Unit Fuel Consumption	B	C	B	B	B	B
ECONOMIC CRITERIA						
Min. Yarding Cost						
Min. Hourly Cost	A	A	B/C	B/C	B	C
Max. Hourly Production	C	C	B	D	B	B

(Continued)

DESIRED CHARACTERISTICS	YARDING SYSTEM					
	JAMMER	TRACTOR OR SKIDDER	STANDING SKYLINE		RUNNING SKYLINE	
			SINGLE SPAN	MULTI-SPAN	GRAPPLE YARDING	CHOKER LOGGING
Min. Sensitivity to Stand Density or Yield						
Min. Move-in Cost	A	A	C	C	B	B
Min. set-Up Cost	B	A	C	E	B	B
Max. Annual Utilization	B	C	B	B	A	B
Max. Economic Life						
Max. Return on Equipment Investment						
Max. Return on Stumpage						

A Most Desirable

↓

E Least Desirable

SLASH DISPOSAL

Slash is forest residue consisting of unwanted, generally unutilized accumulations of woody materials on the forest floor. It originates from natural processes and from activities of man such as logging, thinning, road building, or clearing operations. Twigs, branches, bark, tops, stumps, and unutilized or cull logs and trees constitute slash. It is this residue from logging that is of major concern because of the large volumes of slash produced over a vast area in a relatively short period of time.

Most slash residue requires some form of treatment to meet management objectives and to mitigate the impacts of overloading the forest ecosystem with a surplus of organic material. Under natural conditions, fire provides this treatment by preventing excessive fuel buildup. Man's slash disposal treatments should complement the natural forest ecosystem without undue impact on either on or off-site environmental quality.

Principal reasons for slash treatment are to (1) reduce fire hazards, (2) expose mineral soil for seedbed preparation, (3) remove planting, natural regeneration, and growth obstacles, (4) prevent insect buildup, (5) reduce aesthetic impacts associated with slash accumulations, (6) reduce obstacles to movement of domestic animals, big game, and other wildlife (including fish), (7) recycle nutrients, and (8) control forest disease.

In most timber sales, a variety of slash treatment methods are used. They include burning, mechanical treatment, lop and scatter, and no treatment.

Burning includes broadcast and spot burning, and the burning of hand or dozer piles. It must be done at a time when danger of spread into adjoining timber is minimal and smoke dispersal is assured.

Mechanical treatments include burying, trampling, chipping, chopping, crushing, rolling, and high intensity burning. These mechanical treatments, with the exception of high intensity burning, rearrange slash residues. Volumes remain on site. Even though high intensity burning is not a mechanical treatment in the sense of these other described treatments, it fits this category better than the burning category. It is estimated that less than 5 percent of the total acres treated in the SYU will receive mechanical treatment.

The lopping and scattering of slash is a feasible treatment in stands harvested by partial cuts (selective and shelterwood). Deterioration is hastened by placing slash in close contact with the ground where micro-climatic conditions favor more rapid decay.

No treatment is normally not an acceptable option, as it usually does not meet land management objectives. Undesirable aesthetics, potential insect population buildup, stand regeneration problems, and obstacles to wildlife and livestock movement remain. Perhaps the greatest threat is that of a wildfire starting in or near untreated slash and subsequently gaining momentum as a result of the slash accumulations.

DEVELOPMENT

Practices included in the development phase of the timber management program are primarily aimed at re-establishing trees on forest land following harvest or natural catastrophies and insuring satisfactory or optimum growth of these forests. Actions directly associated with timber harvest, such as cutting and slash disposal treatments to provide regeneration through natural seeding, are discussed in Chapter 1, Harvest and Slash sections. The practices discussed below (site preparation, regeneration, and stand improvement cutting) are in the general order in which they might be carried out on the ground, although several may be accomplished simultaneously. Not all of these practices are carried out on a given area. Many of these practices represent alternate methods, the choice of which is dependent upon the condition of the timber stand, productivity of the site, economics of the treatment, and other uses.

Site preparation is required whenever it is necessary to alter site conditions prior to reforestation. The basic principle of site preparation is to reduce competition and/or expose mineral soil. Site preparation is usually not a separate operation; whatever preparation is needed is normally accomplished through slash disposal operations.

To supplement natural regeneration, tree seedlings are planted for reforesting cutover areas. Tree planting can be done by hand, using tools such as hoes, mattocks, dibbles, power augers, or tractor-drawn machines where terrain permits. Within the SYU, hand tools are used almost exclusively. Seedlings used in the reforestation program are classified as "bare-root" or "containerized." Bare-root seedlings are lifted from growing beds in outdoor forest nurseries prior to breaking dormancy (initial spring growth); they are then inspected, sorted and culled, packaged and placed in cold storage until forest planting sites are clear of snow and frost, at which time they are

transported to the site for planting. Conversely, containerized seedlings are grown in individual containers in a controlled environment (heat, light, water, fungicides, and fertilizers). The seedlings can be planted whenever the ground and weather conditions are optimum as plant dormancy is not a factor. Seedlings are delivered to the site in their containers and, depending on the type, are either removed from the container and planted, or planted as a unit.

In direct seeding, seed may be applied by broadcast seeding from helicopters or by ground crews, either broadcasting or spot seeding. Direct seeding operations are recommended only where the site index is 60 and above. However, since site index in our stands very rarely exceeds 40, the direct seeding method will be rarely used. If and when it is used, seeding rates per acre should approximate the natural seeding rates of a better than average seed year.

In a thinning operation, surplus trees in established stands of young, pre-merchantable or merchantable timber are removed, so as to release selected trees from competition for light, moisture, or nutrients; and thereby concentrate growth potential of the stand on few trees of better quality (see Figures 6 and 7). The primary objectives of this practice are to produce merchantable wood volume and financial returns earlier than the unthinned stands would and to produce more harvestable wood fiber, along with recovering usable fiber which would normally be lost to mortality. With existing demand for posts and poles in the SYU, much of the thinned material is utilized, bringing down the cost of thinning and providing a usable product.

By far, the most common method for removing surplus trees involves the use of power saws. Chemical silvicides will not be used for thinning in this SYU. Besides the environmental issue, silvicides have lacked popularity due to their tendency to "run" from the intended tree to adjoining trees. This condition is made possible by

FIGURE 6

Dense unthinned Lodgepole pine stand
located in Centennial Mountains near Monida, Montana
(SW portion of Dillon SYU)

FIGURE 7

Lodgepole pine stand following thinning

certain tree species (such as lodgepole pine) growing on intertwining root systems. The tree species receiving the bulk of our thinning efforts include lodgepole pine, and, to a lesser extent, Douglas fir. Leave trees are selected on tree condition and spacing. They almost always are the more dominant of the overstory, and must have good potential for maturing into sound, usable trees. The exception to this may be when thinning is done for the purpose of removing diseased trees in order to control an infection, such as dwarf mistletoe, comandra rust, or western gall rust.

PROTECTION

The primary objective of the forest protection activity is to eliminate or minimize losses to the timber resource and other forest resource values resulting from fire, insects and disease, weather damage, and trespass.

The basic approaches taken on the ground to protect the forest resource from fire, or to control its spread, are suppression and prevention.

Suppression activities include all of the current control practices, such as aerial retardants, heavy equipment, and organized crews. Throughout most of the SYU, any combination of these control practices can be used to control wildfire quickly and efficiently; however, a portion of the Centennial Valley, Humbug Spires, and Beartrap Canyon are three designated primitive areas where mechanized ground attack is generally prohibited and minimal site disturbance receives higher priority than efficient fire suppression. A more thorough discussion of these primitive areas and additional area restrictions can be found in the Butte District's Land Use Plans. While these areas are excluded from the "proposed action," a fire in them could easily spread to adjoining forest land.

Fire prevention activities include slash disposal, fire roads, public education, and contract inspection. Slash disposal helps in the reduction of surface accumulation of forest fuels left behind after logging and thinning operations.

Skid roads, fire breaks, and main haul roads often help to make areas more accessible to fire crews. Public education consists of informing the public of potentially hazardous areas. By signing these areas and patrolling them during critical periods, the potential of man-caused fires is reduced. Also, during extremely critical conditions,

forest lands may be closed to all woods operations and general public use. Inspection of logging equipment for compliance with state and federal fire laws under the terms of the timber sale contract also helps reduce the number of fire starts.

The objective of forest insect control is minimizing forest damage by preventing or suppressing epidemic outbreaks of insect populations. Two serious forest insect epidemics presently exist within the boundary of the SYU. They are caused by mountain pine beetle and western spruce budworm. The mountain pine beetle is not, at this time, a serious pest on NRL lands; however, the western spruce budworm situation is more significant.

Egg mass surveys conducted during the fall of 1976 by the U.S. Forest Service to determine population trends for the budworm indicate populations will continue to be high on much of the SYU. This will result in mortality and top killing with heavy defoliation of Douglas fir in some areas. Coordination with the Forest Service on a draft EIS covering the budworm indicates the difficulty of insect control from either direct attack measures or silvicultural means.

As a result of the U.S. Forest Service study and in consideration of our planning system data, the following actions will be taken on the NRL in relation to the spruce budworm problem:

1. Specific action pertaining to budworm control measures will be considered on a case-by-case basis and an EAR, or EIS if required, will be written at that time.

2. The results of research and study on the budworm problem conducted by the Forest Experiment Station will be monitored by BLM and incorporated into our management criteria.

3. Insect damaged timber will be salvaged as part of the normal timber sale plan and, if necessary, we will conduct an accelerated timber salvage program subject to the principles of multiple use, environmental quality, and sustained yield.

Control practices can be classified as silvicultural, direct, and biological. The choice of which method used primarily depends on the species of insect to be controlled, the degree of infestation, and the conditions that characterize the infested area.

Silvicultural control employs the use of silvicultural practices directed towards preventing the occurrence of insect outbreaks as opposed to control actions taken to suppress epidemic infestations. These practices maintain the forest in a healthy condition and regulate its growth so that food conditions are unfavorable for insect population buildup. The quantity and quality of insect food are controlled by regulating stand composition, density, vigor, and age. Practices include harvesting and/or thinning trees from stands most susceptible to insect attack. Cutting and regeneration practices can be designed to favor mixed species timber stands, since they are less susceptible to insect damage than pure stands. These practices are an integral part of the timber management program.

Direct remedial control involves mechanical and chemical methods aimed at destroying the beetle and larvae stage of certain insects. They include the following methods:

1. Sanitation cutting where the infested trees are felled and removed as marketable material or treated by sun-curing or burning.

2. The application of insecticides, usually by aerial spraying. This method is usually considered in control of defoliating insects such as spruce budworm. Due to the high cost and environmental consideration, this method is reserved for areas where an insect

problem is or has potential of becoming severe and economic analysis and environmental considerations show it to be a feasible project.

3. Direct burning of infested, unmarketable material on the site, after felling and piling.

Another facet of forest protection involves biological control. Many species of parasitic and predaceous insects as well as insect-eating birds and mammals offer promise in preventing buildup of insects to epidemic levels. It is in terms of prevention rather than control of a damage problem where this method offers the most promise. Biological agents often do control epidemics, but a time lag is involved where the control organism may take several years to overtake the damaging insect. The damage caused to the stand during this time lag is often unacceptable in economic terms.

Maintenance of biological control agents is often an integral part of good forest management. Maintenance of diverse, natural systems is important. For instance cavity-nesting birds such as woodpeckers consume great numbers of insects, but if no suitable nest trees are left in harvesting programs, the habitat and population of woodpeckers will decline.

More exotic aspects of biological control include artificial production of control organisms and introduction of foreign control agents to control an introduced pest. Present knowledge does not allow the manager to make consistent, effective use of these methods at this time.

The objectives of forest disease control practices are to eliminate or minimize the occurrence or spread of dwarf mistletoe, comandra rust, western gall rust, and other tree diseases. These diseases may be enhanced by non-living environment, such as

unfavorable soil or atmospheric conditions, or by viruses (which we know little about). The majority of disease, however, are caused by the activities of living organisms; i.e., bacteria, fungi, seed plants, and animals, including insects.

Disease control measures currently in use in this SYU are limited to silvicultural or physical measures. Chemicals are available, but not widely used. Biological control, like chemical control, has strong immediate appeal but effectiveness in the long run is limited and there is little potential for field use during the immediate future.

Silvicultural control is aimed at the prevention or minimization of future disease outbreaks, as opposed to actions taken following infestations, and include such practices as: (1) species conversion; (2) development of mixed species stands, particularly when diseases are host specific; (3) maintaining stands in healthy and vigorous conditions by regulating composition, density, and age; and (4) genetic selection through marking which favors resistant trees.

The success of physical control is dependent upon the ability to remove the source of infection. However, once the disease has infected a tree, it is virtually impractical to cut it out of the tree. Thus, control prescriptions are directed towards removing infected trees from the stand. For example, mistletoe infected trees can be used as a seed source. However, once the new stand is established, the infected seed trees must be removed to prevent the spread of mistletoe to the new stand. Dwarf mistletoe infection of lodgepole pine is the only major disease problem on the SYU at this time.

Losses due to weather which can be somewhat mitigated by management are wind throw and snow break. Stagnant dense stands are susceptible to snow break due to a dense canopy and the presence of

structurally weak trees. Thinning these stands can remove weak trees as well as allow snow to reach the ground, avoiding crown interception, and increasing available moisture. Timber sale marking procedures must consider blowdown risk in leave trees and stands bordering clear cuts. This can be done by observing past history evidence by wind thrown trees, root development on wind thrown trees, soil conditions, and exposure to high wind, e.g., ridge tops.

Timber trespass is the unauthorized removal of forest products from the Public Lands. The objectives of a trespass program on the SYU are the prevention and elimination of timber trespass and the collection of compensation for any loss or injury suffered by the United States.

CHAPTER 2

DESCRIPTION OF THE ENVIRONMENT

The environment, as discussed here, will be that found on or closely associated with those tracts of Public Lands listed in the various Unit Resource Analyses as suited for a sustainable forest management program.

The following description will be in generalities. More site-specific detail will be given in the EARs on individual management plans and timber sale proposals. More detailed descriptions of the environment are found in all land use plans within the SYU.

CLIMATE AND AIR QUALITY

Climate in the Dillon SYU is extremely varied due to wide ranges in aspect and elevation. Rainfall ranges from 8 to 26 inches per year depending upon elevation. Approximately 13 percent of the precipitation occurs from January through March, 72 percent from April through September, and 15 percent during the period October through December.

The north and east slopes at higher elevations where timber grows are cool and moist. South and west slopes are warm and dry, resulting in more severe sites for tree growth. The average date of first frost at highest elevations on SYU is August 13. The last freeze at these same elevations occurs near the end of June. Growing season varies from less than 50 days in the Centennial Range to 100 at lower elevations in the Jefferson valley.

Aspect (compass direction of slope faces), slope (steepness), and elevation must all be carefully considered in sale planning as there can be large variations in each on a given timber sale.

Winter weather is affected by cold air masses from Canada, and, to a more minor extent, from Pacific air masses spilling over the Continental Divide from the west. Summer precipitation is usually derived from air masses originating in the Gulf region.

Air quality throughout timber producing areas of the SYU is high and may best be described as "mountain fresh." Severe dry weather may produce dusty periods when particulate matter may become visible as haze. High timbered elevations are characterized by an abundance of clear weather and good air distribution during short periods of fall and winter slash burning at local levels.

SOILS AND GEOLOGY

Physiography

The area covered in this analysis is one of semi-aridity, rugged topography, and sparse population. The Continental Divide follows along the southern border of Montana from Yellowstone Park westward to near the head of the Bitterroot Valley, then bending eastward to a point east of Butte, and then northward, passing a short distance west of Helena. West of the Divide, three major tributaries of the Clark Fork drain northward following broad valleys separated by rugged mountain ranges to join the Clark Fork which flows northwestward into the Columbia River. East of the Divide, three tributaries of the Missouri River; the Jefferson flowing from the southwest, the Madison from the south, and the Gallatin from the southeast, join at Three Forks to form the Missouri River.

The drainage patterns in the Dillon SYU are largely (but not entirely) controlled by a series of basin valleys separated by linear mountain ranges. The rivers flow along these elongate basins throughout most of their length, cutting across the ranges through steep-walled gorges when passing from one basin to another. Most of these valleys and ranges have a north-south trend. The Sapphire Range separates the Bitterroot and Rock Creek valleys, the Tobacco Root and Gravelly Ranges separate the Jefferson River drainage from the Madison Valley, the Madison Range separates the Madison and Gallatin Valleys, and the Big Belt Mountains separate the Upper Missouri and Smith River Valleys.

The Centennial Range is an exception to this general trend. This range lies along the southern border of the state west of Yellowstone Park. North of it lies the Centennial Valley through which Red Rock Creek flows westward to join the Red Rock River.

Much of the more recent geologic history of southwestern Montana can be interpreted from the physiography of the region. Remnants of high level erosion surfaces testify to the former reduction of the area to a near peneplane. Other events of the erosion cycle are recorded by such features as marginal terraces, superimposed drainage patterns, and drainage reversals. Some of the more recent seismic activity has produced the well preserved fault-scarps which flank many of the mountain ranges. Pleistocene glaciation has greatly modified the landforms of the higher mountainous areas and has contributed much to the scenic beauty of the region.

Soils

Five principal factors are responsible for the formation of soils. They are climate, vegetation, topography, and geology interacting through time.

The principal soils in the Dillon SYU associated with the mountainous terrain and thereby the forested lands are cold soils that indicate recent (geologically speaking) development, classified as Cryochrepts. Two other classes exist, the cold soils with dark, usually high organic matter surfaces called Cryoborolls and the cold light brownish colored, low organic matter soils with clayey subsoils called Cryoboralfs. Trees are usually associated with the Cryochrepts and Cryoboralfs, while grasslands are usually associated with Cryoborolls as past and frequently present vegetative types.

The prefix "cry" in these soil classifications originates from cryic (GR. Kryos) meaning or relating to coldness. In the mineral soils of the Dillon SYU, it suggests mean summer temperatures at 20 inches (50 cm) are higher than 32° F. (0° C.) but less than 47° F. (8° C.).

Though considerable overlap occurs, the cryochrepts are more common around 7,000 feet (2,132 meters) elevation. The cryoborolls are more

common near 6,500-7,000 feet (1,980-2,132 meters). Cryochrepts occur above 8,000 feet with considerable rock outcrop, generally of Precambrian gneiss, considered to be about 2 billion years old.

The soils of the mountains in the Dillon SYU can be generally grouped into three associations:

1. The Cryochrepts - Cryoboralfs - Rock Outcrops Association occurs above 6,000 feet (1,820 meters), but does not generally exceed 8,000 feet (2,590 meters). The association is best described as having steep and very steep, shallow to deep, well-drained soils, with rock outcrops on mountain tops and steep mountain sideslopes.

2. The Cryoborolls - Cryochrepts - Cryoboralfs Association generally occurs above 6,500 feet (1,980 meters) but below 8,000 feet (2,590 meters). The cryoborolls occur on similar topography as the above association, but do not have a clayey subhorizon deeper than 20 inches (60 cm) unless the texture is coarser than loamy very fine sand in any horizon above.

3. The Rock Outcrop - Cryochrepts Association occurs at elevations greater than 8,000 feet (2,590 meters). This association consists predominately of rock outcrop of Pennsylvanian and Mississipian age with generally less than 65 percent soil cover. These cryochrepts are generally very shallow to shallow soils occurring on very steep high elevation mountain slopes.

The following source can be consulted if a more detailed explanation than the basic concept of the soil classes mentioned is desired: Soil Taxonomy, Agricultural Handbook #436.

Each of the above associations use one or more of the soil taxonomic names or the term "rock outcrop." The following material is included to further introduce and simplify those terms. Listed first is the generalized definition for the soil class followed by longer narrative of further explanation.

Definition: Cryochrepts are the young soils showing geologically recent development that:

1. Have a cold or very cold soil temperature throughout most of the year;
2. Do not have a fragipan;
3. Do not have a duripan that is cemented by chemical process that has its upper boundary within 3 feet (1 m) of the soil surface.

These are the cold soils of high mountains or high latitudes that show only slight signs of soil development. They can simplistically be thought of as "recent soils." Some are frozen part of the time in some years. The vegetation is mostly conifers and hardwood trees. Few of them are cultivated. These soils may be formed in recent geologic deposits. They generally have a thin, brownish surface and a brownish subhorizon that shows signs of physical or chemical change. Many have rock within 3 feet (1 m) of the surface. In the United States, these soils are moderately extensive in the high mountains like those in the Dillon SYU. They were mostly considered Subarctic Brown Forest soils in the 1938 classification as modified in 1951 and as Sols Bruns Acides after 1957.

Definition: Cryoborolls are the Borolls that:

1. Have a cold (0° C. to 8° C.) soil temperature throughout the year;
2. Do not have a clay horizon that was formed by weathering of soil material deeper than 60 cm below the surface unless the texture in some subhorizon above the clayey horizon is sandy.

These are the cold Borolls. Summers are cool or short. Most of them in the United States are in the mountains of the western states.

In addition to a dark brown to dark grayish brown surface, a variety of other horizons are present. These horizons are used to define the subgroups. The Cryoborolls of the Dillon SYU commonly have a calcic horizon in the soil profile.

The Cryoborolls were formed mainly in geologically recent deposits. In the United States, the vegetation on some of them at the time of settlement was either forest or grass. Many have grasses and scattered conifers. Some are now cultivated and used to produce small grains or hay. However, in the Dillon SYU, occurrence of these soils at higher elevations precludes this use. Many are grazed and also produce some wood products.

The Cryoborolls were mostly included with Chernozems and Brunizems in the 1938 classification as modified in 1952. Because they are very cold and commonly are inaccessible, they have received relatively little attention in the United States.

<u>Definition</u>: Cryoboralfs are the Boralfs that:

1. Have a cryic temperature regime;
2. Have an argillic horizon that has its upper boundary within 20 inches (60 cm) of the surface;
3. Show a buildup of clay weathered from a horizon above.

These are the Boralfs that have a cryic temperature regime and the clayey horizon has its upper boundary within 60 cm of the soil surface unless either there is a sandy particle-size class or there is no tonguing or interfingering of light or white materials in the clayey horizon. Many Cryoboralfs have tonguing of white or light-colored materials in the upper part of the clayey horizon. There may also be a horizon high in clacium below the clayey horizon, but there is not a hard pan or sodium rich horizon.

The Cryoboralfs of the United States are in the mountains of the western states and have an evergreen vegetation. Virtually none of them are cultivated because their slopes are steep and the growing season is short.

The Cryoboralfs were mostly called Gray Wooded soils in the 1938 classification as modified before 1949.

Possible included soil series of the Dillon SYU are the Cryoborolls, Mucet, Saw Creek, and Shook. Other series included here would be the series of the high elevations. They are the Blaine, Cheadle, and Redlodge. Of the Cryoboralf class, the Lake Creek and Gambler are the possible series. The possible soil series in the Cryochrept class are the Merino and Garlet. Other soil series are sure to be present, but before names are given the soils will need to be correlated.

All of the above mentioned soil series have loamy textures and are generally skeletal. Skeletal soils are soils that have greater than 35 percent gravel size or larger material, which has a definite influence on soil moisture.

More detailed information can be acquired from the USDA - Soil Conservation Service's numerous publications and the Clyde Park-Dillon 161 kv and 69 kv Transmission Lines Draft EIS, January through May 1976.

Erosion Potential

Most of the soils encountered at high elevations in the Dillon SYU are subject to erosional processes, especially when denuded.

Road construction, culvert placement, cutbank slope, roadside ditches, skid trails, etc., are all sources of potential erosion and sediment transport.

The shallow-very shallow soils occurring on very steep slopes at high elevation are especially sensitive due to their loamy nature, usually short growing season, and low organic matter content, that does not allow them to re-vegetate as rapidly as lower elevation soils, or provide them with the binder to resist erosional processes.

Glossary of Soils Terms

Argillic Horizon: A lower horizon, called B, that has formed by illuviation of clay. Illuviation is the process by which genetic clay is translocated within the soil.

Duripan (hardpan): An indurated horizon cemented by materials such as aluminum silicate, silica, $CaCO_3$, and iron.

Fragipan: Dense and brittle pan or layer in soils that owe their hardness mainly to extreme density or compactness rather than high clay content or cementation. Removed fragments are friable, but the material in place is so dense that roots cannot penetrate and water moves through it very slowly.

Mineral Soil: A soil consisting predominantly of, and having its properties determined predominantly by, mineral matter. Usually contains 20 percent organic matter, but may contain an organic surface layer up to 30 cm thick.

Pans: Horizons or layers, in soils, that are strongly compacted, indurated, or very high in clay content.

Series, Soil: A group of soils developed from a particular type of parent material and having genetic horizons that, except for texture of the surface layer, are similar in differentiating characteristics and in arrangement in the profile.

Shallow Soil: A soil less than 20 inches deep but greater than 10 inches.

Soil: (1) The unconsolidated mineral material on the immediate surface of the earth that serves a natural medium for the growth of land plants; (2) The unconsolidated mineral matter on the surface of the earth that has been subjected to and influenced by

genetic and environmental factors of: parent material, climate (including moisture and temperature effects), macro- and micro-organisms, and topography, all acting over a period of time and producing a product-soil that differs from the material from which it is derived in many physical, chemical, biological, and morphological properties and characteristics.

Soil Association: (1) A group of defined and named taxonomic soil units occurring together in an individual and characteristic pattern over a geographic region, comparable to plant associations in many ways. (Sometimes called "natural land type.") (2) A mapping unit used on general soils maps, in which two or more defined taxonomic units occurring together in a characteristic pattern are combined because the scale of the map or the purpose for which it is being made does not require delineation of the individual soils.

Soil Horizon: A layer of soil or soil material approximately parallel to the land surface and differing from adjacent genetically related layers in physical, chemical, and biological properties or characteristics such as color, structure, texture, consistency, kinds and number or organisms present, degree of acidity or alkalinity, etc.

Texture, Soil: The relative proportion of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are sand, loamy sand, sandy loam, loam, silt loam, silt sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Geology

Southwestern Montana is an area in which nearly all types of geology are admirably displayed. All of the geologic systems, with the exception of the Silurian, are represented by outcropping formations. In the mountainous areas, the formations crop out as sinuous, narrow, and discontinuous bands, whereas in the plains and basin areas the outcrops are broad and extensive. Precambrian rocks may be subdivided into: (1) the oldest rocks, the older metamorphic complex which consists of gneisses, schists, marbles, and quartzites; and (2) the Belt series consisting of only slightly metamorphosed sediments. Outcrops of the metamorphic complex are roughly limited to the area south of a line connecting Argenta, Butte, and Livingston, and a small area in the Little Belt Mountains uplift. The Paleozonic formations are largely marine and were originally continuous throughout most of the region. However, Ordovician strata are now restricted to the extreme southern and eastern portions of the area, although they were probably originally deposited over a much wider extent. Mesozoic strata are both marine and non-marine, consisting largely of clastic materials. The Triassic is restricted to the southern part of the SYU. Jurassic and Cretaceous rocks are distributed throughout the region. Cenozoic sediments are exclusively non-marine and cover as alluvial and lacustrine basin deposits in the mountainous areas and as piedmont deposits in the eastern plains portion and in some mountains in the western area. Thin Tertiary gravel deposits also occur associated with high level erosion surfaces in some of the mountain ranges. Pleistocene glacial moraines occur along the upper reaches of valleys in most of the mountain ranges of the region.

The geologic structure of the region is highly complex. Pre-Laramide strata have been involved in the Laramide Orogeny (the period of geologic time during which the Rocky Mountains were formed). Superimposed on these Laramide structures is a system of post-Laramide normal faults which are at least directly responsible for the configuration of many of the mountain ranges.

Igneous rocks are well represented in the region by both intrusives and extrusives. Best known of the intrusives is the Boulder batholith between Butte and Helena. The northeastern edge of the Idaho batholith extends into western Montana in the Bitterroot Mountains. Numerous smaller batholiths and stocks occur in some of the mountain ranges, and dikes and sills are common throughout the area. Thermal metamorphism of the sedimentary host rocks enclosing the large plutonic rocks often has destroyed the lithologic features from which correlation of strata can be made. This problem is frequently found in lode mining camps, the locations of which are indirectly determined by the intrusive contacts. Volcanic deposits consisting of lava flows and pyroclastic materials, some of which have been reworked by stream action, occur in the Livingston formation of late Cretaceous or early Tertiary age. Younger volcanic rocks occur in the general vicinity of Yellowstone National Park.

A glossary of geology terms follows.

Glossary of Geology Terms

Alluvial: Types of deposits made by flowing water.

Batholith: A huge, intrusive igneous body of at least 40 square miles in extent.

Belt Series: A great thickness (perhaps 40,000 feet) of younger Precambrian rocks. Argillaceous strata predominate.

Clastic: Consisting of fragments of rocks or of organic structures that have been moved individually from their place of origin.

Cretaceous: Applied to the third and final period of the Mesozoic era and to the strata deposited in that period.

Gneiss: A metamorphic rock of coarse grain size, characterized by mineral banding in which light and dark minerals are separated.

Lacustrine: Deposits which have accumulated in fresh water lakes and marshes.

Laramide: A period of earth movement in early Tertiary times.

Mesozoic: An era of geologic time following the Paleozoic and preceding the Cenozoic; and the strata deposited during that time.

Metamorphic: Rocks which have been changed from the original rock by heat, pressure, or introduction of chemical substances.

Pyroclastic: Produced by explosive ejection of material from a volcanic vent.

Schist: A crystalline rock that can be readily split because of having a foliated structure.

Stock: A body of intrusive igneous rock like a batholith but smaller.

WATER

Virtually the entire drainage of the Dillon SYU consists of creeks and rivers that are either directly or indirectly tributaries of the Missouri River. Water quality on timber producing areas of the unit can be collectively described as good to excellent.

There are water quality variations within stream as well as from stream to stream which occur daily as well as seasonally. These variations are due in part to climatic conditions; geology, biota within the stream, water temperatures, livestock grazing, and man's activity. Seasonal fluctuations may approach or exceed recommended standards for some parameters, such as turbidity, but usually are of short duration.

Watersheds in timbered areas are generally stable and in good condition. Some problem areas are discussed under geology and soils.

VEGETATION

The Dillon SYU is a mosaic of forest, shrub, and grassland formations. Their presence is a function of soil, climate, and land use. As moist air from the Pacific moves east over the mountains of the Continental Divide much of the moisture is lost, and throughout the ranges of drier areas of the SYU there is not enough precipitation to allow for forest development. Such areas are covered by extensive mountain grasslands and forests are restricted to moister and cooler aspects.

Wildfire has played an important role in the formation of Montana's forests. Most forests in the state except small stands at high elevations and moist sites show evidence of fire within the last 200 years. The major tree species in the SYU and their significance to the forest management program are:

1. Ponderosa pine (Pinus ponderosa). Within the SYU, this species occurs in commercial quantities only at the north end of Jefferson and Broadwater counties. It occupies the driest sites suitable for intensive management and is found in mixture with Douglas fir. This species is relatively free of insect and disease epidemics in Montana, but appears to be physiologically unadapted to an increase in range.

2. Douglas fir (Pseudotsuga menziesii). This species covers a broad range of environments in the SYU. It ranges from warm dry southern aspects through cool moist northern aspects. Sites found on the moister end have the best potential for timber production. In many Douglas fir stands on the SYU, only Douglas fir is able to reproduce beneath the crown canopy. When given an opportunity, following fire or logging, with seed source available, lodgepole pine will invade the disturbed area. Douglas fir has been susceptible to repeated widespread attacks from the spruce budworm in this area.

3. Lodgepole pine (Pinus contorta). This species exists on the SYU as a seral type. It is normally a temporary occupier of sites which have suffered prior denudation by fire, insects, or logging. Lodgepole pine is a prolific seed producer and readily invades areas recently denuded by fire. It is becoming a valuable species for wood products and is not susceptible to attack by the western spruce budworm, which is a serious enemy of Douglas fir in the SYU. The mountain pine beetle occasionally attacks mature lodgepole but can often be silviculturally controlled.

4. Engelman spruce and subalpine fir. These occur to a lesser degree than the above mentioned species. They are often found as an understory component due to their tolerance for shade. They are easily damaged by fire and are usually found along the moist soils of creek bottoms and in high alpine types which are rarely disturbed by fire. They are usually harvested as an incidental tree along with the more major species.

Existing forest stand conditions by acres, stocking percent, and size classes by county.

ACRES OF STOCKING

County	Seedlings Saplings	Pole Sized Poor	Pole Sized Med	Pole Sized Well	Sawlog Sized Poor	Sawlog Sized Med	Sawlog Sized Well	Non Stocked	Aspen
Beaverhead	7,053	3,276	9,818	18,156	5,110	12,222	18,819	1,575	1,603
Broadwater	558	872	1,315	1,025	326	688	1,055	--	--
Deerlodge	307	180	590	360	--	77	615	--	--
Gallatin	120	240	334	334	180	369	180	--	--
Jefferson	1,924	2,082	5,289	2,574	3,829	5,960	6,874	330	809
Madison	2,174	5,729	6,213	10,359	5,716	10,385	15,521	68	479
Silver Bow	584	728	1,487	1,391	1,491	4,475	2,898	183	--
Totals	12,720	13,107	25,046	34,199	16,652	34,176	45,962	2,156	2,891

72,352

96,790

169,142

184,018

Criteria: Stocking % (Crown Density)

Poor	--	15-40
Medium	--	40-70
Well	--	70-100

Size Class - (in DBH)

Seedlings & Saplings	--	1 to 4.9
Poles	--	5 to 8.9
Sawtimber	--	9+

CLIMAX VEGETATION SW MONTANA

FOOTHILLS AND MOUNTAINS

37

Silty Range Site, 10-14" P. Z.

Bluebunch wheatgrass, rough fescue*, needleandthread, prairie junegrass, western and thickspike wheatgrass, green needlegrass, basin wildrye, threadleaf sedge, native legumes, big sagebrush, winterfat, Idaho fescue

*Codominant with bluebunch wheatgrass west of the Continental Divide but insignificant on east side at this P. Z.

38

Silty Range Site, 15-19" P. Z.

Rough fescue, Idaho fescue, bluebunch wheatgrass, Columbia needlegrass, basin wildrye, spike fescue, parry danthonia, slender wheatgrass, lupine, sticky geranium, arrowleaf balsamroot, prairiesmoke, big sagebrush, tall larkspur, prairie junegrass, timber danthonia, big bluegrass

39

Silty Range Site, 20-24" P. Z.

Rough fescue, Columbia needlegrass, Richardson needlegrass, mountain brome, bearded wheatgrass, slender wheatgrass, basin wildrye, Idaho fescue, lupine, sticky geranium, prairiesmoke, tall larkspur, big sagebrush, spike fescue, spike trisetum, purple oniongrass, nodding brome, quaking aspen, American bistort

40

Silty-Clayey Range Site Complex, 10-14" P. Z.

Silty: Same as Site No. 37

Clayey: Same as Site No. 42

41

Silty-Clayey Range Site Complex, 15-19" P. Z.

Silty: Same as Site No. 38

Clayey: Same as Site No. 43

42

Clayey and Shallow Clay Range Site Association, 10-14" P. Z.

Bluebunch wheatgrass, western wheatgrass, green needlegrass, basin wildrye, prairie junegrass, plains reedgrass, big sagebrush, milkvetches, American vetch, biscuitroot

43

Clayey and Shallow Clay Range Site Association, 15-19" P. Z.

Rough fescue (except south central Montana), bluebunch wheatgrass, Columbia needlegrass, western and thickspike wheatgrass, Idaho fescue, basin wildrye, lupine, sticky geranium, arrowleaf balsamroot, big sagebrush, prairiesmoke, prairie junegrass, deathcamas

44

Saline Lowland Range Site, 10-14" P. Z.

Basin wildrye, alkali sacaton, Nuttall alkaligrass, alkali cordgrass, slender wheatgrass, western wheatgrass, inland saltgrass, greasewood, silver buffaloberry

45

Sands and Sandy Range Site Association, 10-14" P. Z.

Sands: Prairie sandreed, needleandthread, Indian ricegrass, bluebunch wheatgrass, threadleaf sedge, native legumes, skunkbush sumac, yucca

Sandy: Needleandthread, bluebunch wheatgrass, native legumes, threadleaf sedge, big sagebrush, prairie junegrass, skunkbush sumac

46

Limy-Shallow-Very Shallow Range Site Complex, 10-14" P. Z.

Limy: Bluebunch wheatgrass, prairie junegrass, needleandthread, threadleaf sedge, western and thickspike wheatgrass, Sandberg bluegrass, native legumes, winterfat

Shallow: Bluebunch wheatgrass, rough fescue, needleandthread, big sagebrush, prairie junegrass, western wheatgrass, Sandberg bluegrass, gray horsebrush, phlox, native legumes

Very Shallow: Bluebunch wheatgrass, prairie junegrass, western wheatgrass, threadleaf sedge, phlox, needleandthread, Sandberg bluegrass, native legumes - mountain mahogany, limber pine, antelope bitterbrush, big sagebrush, and Rocky Mountain juniper in cracks and crevices of bedrock

47

Subirrigated and Wetland Range Site Association

Tall reedgrasses, tufted hairgrass, American mannagrass, tall sedges, slender wheatgrass, bearded wheatgrass, basin wildrye, willows, shrubby cinquefoil, prairie cordgrass, elephanthead pedicularis, monkeyflower, native clovers, Indianpaintbrush, common blue-eyedgrass

48

Alpine Grassland on Deep to Moderately Deep, Well Drained to Poorly Drained Soils with Cryic Temperature Regimes and Dark Brown and Very Dark Brown Surfaces on Sloping to Steep Windswept Mountain Tops Above Timberline, 40-70" P. Z.

Tufted hairgrass, sedge, sheep fescue, alpine bluegrass, alpine timothy, native legumes, wolf willow, red mountainheath, white dryad, alpine bluebell, bluejoint, purple reedgrass, moss silene, yellow avens, tufted phlox, eriogonum, American bistort, shrubby cinquefoil

49

Forest-Grassland Complex, 15-19" P. Z., on Shallow to Moderately Deep Soils with a Frigid Temperature Regime and Brown to Dark Brown Surfaces under Grassland and Brown to Gray Surfaces under Forest on Sloping to Steep Terrain

Forest: (60%) Douglas-fir, common snowberry, white spiraea, Oregongrape, heartleaf arnica, Columbia needlegrass, Idaho fescue, bearded wheatgrass, kinnikinnick

Grassland: (40%) Bluebunch wheatgrass, Idaho fescue, Columbia needlegrass, basin wildrye, spike fescue, lupine, arrowleaf balsamroot

50

Rocky Mountain Juniper and Limber Pine on Shallow Soils with a Frigid Temperature Regime and Dark Grayish Brown Surfaces Developed from Limestone or Calcareous Sandstone Residuum on Moderately Steep to Very Steep Mountain Slopes - Rock Outcrop 40-70%, 10-14" P. Z.

Typical overstory composition is:	Rocky Mountain juniper	60%
	Limber pine	40%

51

Douglas-fir and Ponderosa Pine Climax Forests on Deep Soils with Cryic or Frigid Temperature Regimes and Light Brownish Gray, Brown, or Grayish Brown Surfaces on Hilly to Steep Mountain Slopes, 16-22" P. Z.

Typical overstory composition is:	Douglas-fir	60%
	Ponderosa pine	40%

52

Subalpine Fir, Douglas-fir, and Ponderosa Pine Climax Forests on Deep Soils with Cryic or Frigid Temperature Regimes and Grayish Brown, Light Brownish Gray, or Light Yellowish Brown Surfaces on Moderately Steep to Very Steep Mountain Slopes East of the Continental Divide, 16-35" P. Z.

Typical overstory composition is:	Subalpine fir	50%
	Douglas-fir	35%
	Ponderosa pine	10%
	Engelmann spruce	5%

53

Subalpine Fir and Douglas-fir Climax Forests on Deep Soils with Cryic Temperature Regimes and Pale Brown or Light Brownish Gray Surfaces on Moderately Steep to Very Steep Mountain Slopes, 20-45" P. Z.

Typical overstory composition is:	Subalpine fir	65%
	Douglas-fir	25%
	Engelmann spruce	10%

54

Spruce and Douglas-fir Climax Forests on Deep Soils with Cryic or Frigid Temperature Regimes and Brown or Grayish Brown Surfaces and Calcareous Subsoils on Strongly Sloping to Very Steep Mountain Slopes, 20-45" P. Z.

Typical overstory composition is:

Spruce	50%
Douglas-fir	40%
Subalpine fir	10%

55

Subalpine Fir, Douglas-fir, and Ponderosa Pine Climax Forests on Deep Soils with Cryic or Frigid Temperature Regimes and Grayish Brown, Light Brownish Gray, or Light Yellowish Brown Surfaces on Moderately Steep to Very Steep Mountain Slopes West of the Continental Divide, 16-70" P. Z.

Typical overstory composition is:

Subalpine pine	50%
Douglas-fir	35%
Ponderosa pine	10%
Engelmann spruce	5%

56

Douglas-fir Climax Forests on Deep Soils with a Frigid Temperature Regime and Light Gray Surfaces and Calcareous Subsoils on Gently Rolling to Hilly Mountain Foot Slopes and Strongly Sloping to Steep Mountain Slopes, 16-30" P. Z.

Typical overstory composition is:

Douglas-fir	90%
Grand fir	10%

57

Subalpine Fir, Douglas-fir, and Grand Fir Climax Forests on Deep Soils with Cryic or Frigid Temperature Regimes and Light Gray or Pale Brown Surfaces on Steep to Very Steep Mountain Slopes, 30-70" P. Z.

Typical overstory composition is:

Subalpine fir	55%
Douglas-fir	35%
Grand fir	10%

58

Western Redcedar and Western Hemlock Climax Forests on Deep Soils with Frigid Temperature Regimes and Brown to Pale Brown or Light Gray Surfaces on Gently Sloping to Gently Rolling Valley Floors, 20-35" P. Z.

Typical overstory composition is:

Western redcedar	70%
Western hemlock	15%
Grand fir	15%

59

Grand Fir and Douglas-fir Climax Forests on Deep Soils with Frigid Temperature Regimes and Pale Brown or Light Gray Surfaces on Steep to Very Steep Mountain Slopes, 25-60" P. Z.

Typical overstory composition is:

Grand fir	45%
Douglas-fir	45%
Western redcedar & western hemlock	10%

60

Subalpine Fir Climax Forests on Deep Soils with Cryic Temperature Regimes and Brown or Strong Brown Surfaces on Steep to Very Steep Mountain Slopes, 60-100" P. Z.

Typical overstory composition is:

Subalpine fir	70%
Mountain hemlock	20%
Douglas-fir	10%

61

Hardwood Climax Forests on Alluvial Floodplains Along Major Rivers and Growing on Shallow to Deep, Well Drained to Poorly Drained Soils with Frigid Temperature Regimes

Typical overstory composition is:

East of Continental Divide:	Cottonwood	80%
	Other hardwoods	20%
West of Continental Divide:	Cottonwood	80%
	Conifers	20%

62

Rockland and Mixed High Elevation Vegetation Consisting of Forests, Krummholz, and Alpine Areas Growing on Shallow to Deep, Very Gravelly or Very Cobbly, and Stony Soils with Cryic Temperature Regimes, 40-110" P. Z.

Typical composition is:

Rockland	70%
Vegetation	30%

An accurate final list of endangered and threatened plants indigenous to the SYU is not available. The following list is compiled from the Federal Register list on endangered and threatened species (plants); an evaluation of putatively threatened or endangered species from Montana flora; and results of the Beaverhead Integrated Resource Inventory, Dillon Resource Area BLM.

There are three Montana plants listed by the Smithsonian Institute under the Endangered Species Act of 1973. They are:

Silene spaldingii: Collected in only two sites: one in Sanders County and the other in Flathead County. It is not known nor likely to occur on the SYU.

Trisetum orthochaetum: Known only from a locality at Lolo Hot Springs. Its habitat is boggy meadow. It is now known nor likely to occur on the SYU.

Phlox missoulensis: On the original list of rare and endangered species, this plant does not appear to be threatened or endangered in the immediate future. (I.J. Watson, Jr. - An Evaluation of Putatively Threatened or Endangered Species from the Montana Flora 1976).

The study by Watson indicates two additional plants which should be considered as threatened and endangered in Montana including:

Gridelia howellii: Restricted to the foothills of the Swan Range. It is not known nor likely to occur on the SYU.

Penstemon Lemhiensis: Known to occur in Beaverhead County. It is likely to occur in sagebrush grasslands and coniferous forest ecotones.

The following plants were classified as possibly endangered in the Smithsonian list:

Aquilegia jonesii: Remote alpine habitats. Not known to occur on the SYU. Occurs generally on subalpine limestone scree or in rock crevices.

Cardamine rupicola: Endemic to Swan and Mission Ranges. Not likely to occur on the SYU.

Claytonis flava: No records of its occurrence in Montana.

Cryptantha sobolifera: Not likely to occur on the SYU.

Draba apiculata: Restricted to alpine summits of the Bitterroot Mountains.

Rorippan calycina: Eastern Montana.

Of the above plants, it appears only *Penstemon lemhiensis* is of major concern as far as the proposed action is concerned. Darrell Brown of the University of Montana in the Beaverhead Integrated Resources Contract condicted by the BLM in 1976-1977 has listed other plants which deserve further study before being placed on the list.

Artemisia tridentata subsp. *vaseyana* form *spiciformis*

This plant is also known to be on BLM lands in this Resource Area. There is a disagreement as to whether it is a distinct taxon or simply an ecotype. It should be considered for the endangered and threatened list, as it is quite rare. It may occur on the forest edge.

The following plants were suggested for further study to determine their status. They seem to be rare, and therefore should be studied in compliance with Section 7 of the Endangered Species Act of 1973. All of them were found during the summer of 1976.

Artemisia pedatifida Nutt.

Tanacetum capitatum (Nutt.) T. and G.

Lesquerella alpina (Nutt.) Wats. var. condensata (A. Nels.) C. L. Hitche.

Astragalus scaphoides M. E. Jones

Castilleja angustifolia (Nutt.) G. Don

The plants listed below are suggested for further study to determine their status. None of these was found during the study in 1976, but their range could readily include Beaverhead County. They seem to be rare.

Erigeron gracilis Rydb. - Meadows to mid mountains.

Silene repens Pers. var. australe (Hitche and Maguire) C.L. Hitche - Scree

Astragalus terminalis Wats. - Limestone outcrops

Oxytropis besseyi (Rydb) Blank, var. argophylla (Rybd) Barneby - Gravel

Oxytropis lagopus var. atropurpurea (Rydb.) Barneby - Sage plains

Epilobium suffruticosm Nutt. - Gravel stream bottoms

Phlox albomarginata M. E. Jones - Mid and high elevation

Castelleja crista-galli Rydb. - Sage slopes

Castelleja gracillima Rydb. - 5-8,000' wet meadows - possible forest plants

Pedicularis bracteosa var. silifolia (Rydb.) Cronq. - possible forest plants

Most of these plants do not grow under the forest canopy. Several grow along or near the forest plant community and would be subject to potential damage by road development.

ANIMALS

The Dillon Sustained Yield Unit provides diverse timber cover types, including lodgepole pine, Douglas fir, whitebark pine, subalpine fir, and spruce. The area is interspersed with open south-facing sagebrush and grass-sagebrush slopes, wet meadows and bogs, parks, rocky ridges, and willow bottomlands. The diversity of the forested and non-forested environment supports a wide variety of wildlife species, especially the larger ungulates most directly affected by change in timber cover.

The Beaverhead, Wise River, Ruby River, Big Hole, and Madison River drainages support outstanding big game populations and provide year long habitat for elk (Ceras canadensis), mule deer (Odocoileus hemionus), white-tailed deer (Odocoileus virginianus), mountain goat (Oreamnos americanus), bighorn sheep (Ovis candensis), moose (Alces alces), and black bear (Ursus americanus). Grizzly bear (Ursus arctos horribilis) and Rocky Mountain wolf (Canis slupus irremotus) also inhabit the area. The area supports a wide variety of bird life, including upland game birds, waterfowl, raptors, and songbirds. A complete bird list is included in the appendix (List of Birds of Western Montana, USFS).

About 150 miles of stream fishery have been identified thus far. Intensive habitat surveys have been completed on 87 miles of stream, including Metzel, Corral, Tom, Antelope, Bear, Jones, Curry, Red Rock, Price, Big Sheep, Long, Dyce, Middle, Crow, Peet, West, Fish, Ramshorn, Piute, Camp, Odell, and Blacktail Creeks. In addition, the Bighole, Jefferson, Madison, Beaverhead, and Wise Rivers pass through some Public Lands. These rivers are nationally known fisheries.

A review of wildlife species of major management concern in the SYU is as follows:

Mule Deer (Odocoileus hemionus)

Mule deer are found at practically all elevations from under 5,000 feet on sagebrush flats to over 9,000 feet on high mountains, along the Continental Divide. In general, mule deer prefer rather open type country with good interspersion of forage supplies and escape cover of moderate to heavy timber, brush draws, aspen groves, and "breaks." Local studies dealing with mule deer in the area include South, 1957 and Duncan, 1975.

Mule deer undergo elevational migrations to lower elevations during periods of moderate-severe weather and snow cover conditions to seek winter browse range, which consists of curleaf mountain mahogany, big sagebrush, Douglas rabbitbrush, and bitterbrush. A reverse altitudinal migration occurs as snow cover recedes and forbs become available to higher elevations. In most areas, mule deer are associated with timber cover during all months of the year, especially fall - early winter.

Studies dealing with mule deer use of clearcuts, including Day (1973), indicated that mule deer use increased as clearcuts aged (11-20 years). Older clearcuts provided a variety of browse in contrast to younger clearcuts which were predominantly grass. Deer were also less selective than elk to clearcuts, preferring cuts that were heavily laden with slash, which were avoided by elk. Other studies (Reynolds, 1962, 1966; and Pearson, 1968) have shown that deer use decreased following cleanup of slash.

Conifer cover is preferred during summer months as loafing cover. Deer typically feed on moist north slopes near timbered areas. Conifer cover is most intensively used during hunting season, as

security habitat, and during periods of severe winter weather. Deer habitats lacking conifer cover are much more vulnerable to overhunting and disturbance stress.

Elk (Cervus canadensis)

Elk are distributed in most mountainous and forested lands of the area. Substantial elk populations are associated with the forest environment, and wild populations provide recreational sport hunting; popular with both resident and non-resident sportsmen. Local guides and outfitters are dependent upon elk for their livelihood. The Dillon area is known nationally as an important elk hunting area. The Dillon unit presently provides superior habitat for elk.

Elk follow extensive elevational migrations to lower elevations where winter range is critical to the survival of the species. A significant proportion of the SYU timber consists of Douglas fir, at mid to low elevations. Douglas fir is commonly utilized by elk as cover during severe winter weather. Elk typically forage during winter on grassy south slopes, and utilize the contiguous Douglas fir on ridges and upper north slopes as bedding cover.

During early spring, elk utilize south slopes near Douglas fir stands, where early green-up is available.

Calving commonly occurs in or near Douglas fir edges, if snow depth precludes use of higher elevations.

Douglas fir habitat types are intensively utilized in late fall, when heavy snowfall initiates migration toward winter range areas. This cover offers security during the hunting seasons with heavy snowfall, and may reduce stress sufficient to prevent a return to higher elevations where forage is less available.

Elk summer use is typically associated with the spruce, subalpine fir, and whitebark pine habitat types, and to a lesser degree the lodgepole and Douglas fir types where meadows, grassy parks, and wet drainages are associated with these types. Summer range is more extensive than winter range.

Studies dealing with elk in the area include Rouse 1956, Reichelt 1972, and Eustace 1967. There is a cooperative study in progress dealing with Elk-Logging relationships which is, and will be, used to provide guidance to the forest management program.

Data is currently available on food habits and range use of elk in the Gravelly Range, but additional studies would be beneficial to include other areas subject to logging. Because of the high recreation demand, the elk would probably be considered the most important big game species in the area. Trophy hunting of elk is popular with Boone and Crocket records recorded for the area.

Moose (Alces alces)

Moose are associated with forested lands in scattered areas throughout the unit during most months of the year (Knowlton 1960; Peek 1961, 1962, 1963). During spring and summer-fall, moose seem to prefer coniferous areas above 7,500 feet (Knowlton 1960). Research by the Montana Department of Fish and Game reveals two populations in terms of habitat use. One population summers at high elevations in the spruce-fir habitat and migrates to winter at lower elevations in the willow and adjacent lodgepole pine areas. The other population is associated with the willow and adjacent pine-fir types and on a year long basis. Moose prefer dense coniferous stands as cover when they are disturbed.

Since moose forage primarily on browse species, it is generally recognized that seral forest stages produce more forage at more advanced successional stages. Climax forest produces the least forage, but portions of these areas may be important for loafing cover, escape cover, and protection during severe weather periods.

White-tailed Deer (Odocoileus virginianus)

The white-tailed deer exist primarily along river bottoms and foothills in the area. This species would have minor impacts from logging, since logging would occur at higher elevations above the normal range of this species.

Black Bear (Ursus americanus)

Black bear are found throughout the forested habitats in the Dillon unit. Being more widely distributed than the grizzly, the black bear occupies habitat in the wooded foothills and closer to man-caused intrusions. The black bear is most common in areas which are not highly accessible to human activity. Seral forest stages produce more preferred foods than do climax forests. The black bear is considered an important game species in western Montana.

Rocky Mountain Wolf (Canis lupus irremotus)

The Northern Rocky Mountain wolf has been included on the United States list of endangered species (Federal Register: June 4, 1973, Vo. 38 (106):14678). Section 7 of the Endangered Species Act of 1976 (P.L. 93-205) clearly points out the responsibility of all federal agencies to "conserve" endangered and threatened species and the habitats that are critical to their survival.

There is little quantitative information regarding the status of the wolf in the area. Various observations of wolves have been recorded, but additional study is necessary to determine the status and critical habitat needs in the area.

Data regarding protection of den sites, reduction of wolf mortality by humans, and identification of essential habitat, is, at the present time, unavailable and must be evaluated on a case by case basis by a wildlife biologist.

Grizzly Bear (*Ursus arctos horribilis*)

Grizzly observations have been confined to the more remote forested regions of the unit. Habitat suitable for the grizzly generally consists of rock slides, stream bottoms, alpine meadows, and heavy timber. Currently, information on the grizzly is being obtained by the Interagency Grizzly Bear Study Team, and the study area includes Yellowstone National Park and portions of Idaho, Montana, and Wyoming. Grizzly bear sightings have been made on the Beaverhead National Forest near Dillon and on the Targhee National Forest in Idaho.

The grizzly bear is a "threatened" species under the federal rules of the Endangered Species Act (1973); but in Montana, the species is classified as a game species and hunting is allowed under strict regulations. The Yellowstone Ecosystem, which includes the Dillon area, is not open to sport hunting at the present time. The two year agreement regarding areas adjacent to Yellowstone National Park expired in 1976.

A viable grizzly population may exist in the Centennials, but additional inventories and research are necessary to confirm occupancy.

Conflicts between grizzlies and livestock have been reported in the Centennial area, especially on lands withdrawn for the Dubois Experimental Range.

The species is managed by the Montana Department of Fish and Game, and the policy of the commission is as follows: "To perpetuate and manage this unique wildlife species in suitable habitat of the state for the people of Montana (and the nation)." The study of hunter-killed animals is an important tool regarding bear research and management.

Currently, there is little reported conflict between bears and man in the Dillon unit.

The grizzly is known to inhabit the Gravelly Range, and possibly the Centennial Mountains, especially in the vicinity of Slide Mountain. There is a possibility that lands within the Dillon SYU contain Critical Habitat for the grizzly bear. Attempts should be made to obtain all the available data which will be necessary to make these determinations. Delineation of critical habitat is mandatory pursuant to Section 7 of the Endangered Species Act of 1974. No PL within the SYU were proposed as critical habitat by the U.S. Fish and Wildlife Service.

Much of the Centennial Range is essentially primitive and roadless. BLM administers approximately 29,000 acres (38 percent); most of the area is suitable grizzly habitat. Eighty-nine percent of the commercial forest land in the Centennials has been withdrawn from the forest management land base as a designated primitive area.

Birds

Approximately 250 species of birds are found in the unit including upland game birds, waterfowl, songbirds, and raptors. These species include both resident and migratory birds, associated with the many diverse habitat types typical of the area. A complete inventory of all birds associated with major habitats in the Dillon unit is in progress at the present time.

Blue Grouse (*Dendragupus obscurus*)

Blue grouse are commonly found in forested areas within the unit. Research dealing with the life history and ecology of blue grouse is well documented in the literature by Beer (1943), Marshall (1946), Wing (1947), and Bendell and Elliott (1967). Studies dealing with blue grouse on forested areas within Montana are reported by Messehl (1960), Messehl (1963), Messehl and Finley (1967), Messehl and Schladweiler (1969), and Martinka (1972). Blue grouse in the SYU are best represented in semi-open Douglas fir habitats.

Blue grouse are unusual in that they follow an altitudinal migration to lower elevations in spring, brooding at lower elevation foothills, and followed by a migration to higher elevations beginning in fall. During winter, blue grouse are found at the highest elevation within their home ranges. Fall and winter are spent in the coniferous forest on higher mountain ridges, followed in early spring by a migration of males to open forest in lower mountain areas where they establish and defend breeding territories (Bendell and Elliott, 1967). Nesting usually occurs at lower elevations adjacent to forested areas.

Ruffed Grouse (*Bouasa umbellus*)

Ruffed grouse occur primarily in extensive aspen stands and along riparian habitats consisting of mixed conifer, willow, alder, dogwood, and water birch. Aspen, of various age classes, is the primary habitat of ruffed grouse. Ruffed grouse utilizing mixed conifer-deciduous habitats, conifer habitats, and riparian habitats are probably less productive than populations utilizing extensive aspen habitats. Climax forests which would produce substantial aspen cover in the seral stage have a high potential for improvement of ruffed grouse habitat.

Spruce Grouse (*Canachites canadensis franklinii*)

Spruce grouse are limited to forested habitats, principally subalpine fir, spruce, and lodgepole pine. Habitat requirements are poorly known. Pure stands are evidently less preferred than are mixed conifer habitats. Likewise, dense mature stands, lacking in understory, are less preferred than mixed conifer stands with concealing ground cover consisting of shrubs, woody slash and debris, and herbaceous vegetation. Spruce grouse make very little use of Douglas fir habitats in the SYU. Select or shelterwood logging may improve spruce grouse habitat quality, though this has not been verified through scientific study.

Small Mammals, Furbearers, and Predators

Other common species which may be associated with forested habitats include: Canada lynx, cougar, bobcat, coyote, badger, marten, short-tailed weasel, long-tailed weasel, mink, wolverine, water shrew, vagrant shrew, common shrew, several bat species, Columbian ground squirrel, golden-mantled ground squirrel, yellow pine chipmunk, least chipmunk, red squirrel, northern flying squirrel, yellow bellied marmot, northern pocket gopher, beaver, western deer mouse, meadow vole, long-tailed vole, red-backed vole, western jumping mouse, bushy-tailed woodrat, porcupine, showshoe hare, and pika.

The Montana Department of Fish and Game maintains a list of non-game species which have a high priority for management and enhancement. Priority species which may occur on forested lands within the SYU include:

1. Goshawk (confirmed in Jerry Cr.)
2. Sharp-shinned hawk (fairly widespread)
3. Cooper's hawk
4. Pigeon hawk
5. Screech owl
6. Pygmy owl
7. Great gray owl
8. Saw-whet owl
9. Williamson's sapsucker
10. Black-backed three-toed woodpecker
11. Northern three-toed woodpecker
12. Western flycatcher
13. Western bluebird
14. Tennessee warbler
15. Nashville warbler
16. Purple martin
17. Boreal owl
18. Bluejay (confirmed in Big Sheep Cr.)
19. Swamp sparrow

20. Canada lynx (confirmed in Centennial Mtns.)
21. Wolverine (confirmed in Centennial Mtns.)
22. Northern Rocky Mountain wolf (widespread)
23. Mountain phenacomys
24. Marmota caligata (possibly in Centennial Mtns.)
25. Tailed frog

Additionally, the BLM places a great priority upon protection of the neotenic tiger salamander (axoloti) population, which is limited in Montana distribution to Blue Lake. Blue Lake has been designated as a natural area.

Fishes

Forested lands within the SYU comprise portions of watersheds for such major recreational fisheries as the Red Rock, Beaverhead, Madison, Big Hole, Jefferson, and Ruby Rivers. Portions of the Madison and Big Hole have been designated as "Class I" fisheries by the Stream Classification Committee. Sportsmen commonly refer to these streams as "blue ribbon."

Forested lands in the SYU influence water quality, and thus fish habitat quality further downstream.

Typically, small headwater streams in forested areas of the SYU support small, native populations of cutthroat trout of the Yellowstone variety. Brook trout, rainbow trout, brown trout, whitefish, and burbot become more common in downstream and larger stream reaches.

Streams in the Centennial provide the entire upper Red Rock Creek flow where the last remaining, self-sustaining, native population of grayling spawn on private and Fish and Wildlife Service administered lands.

Grayling are common in the Upper Big Hole River, but this population has been periodically sustained by stocking of fry and fingerlings.

Various non-game fishes inhabit streams in the SYU, but these are poorly documented. Common species include mottled sculpin, longnose dace, white sucker, and longnose sucker. Less common species include shorthead sculpin, redside shiner, and mountain sucker.

The SYU includes only two lakes with sport fishery potential, in the Axolotl Lakes complex near Virginia City. Two additional lakes in the Centennial Mountains, Blair and Odell, occur on lands withdrawn for experimental sheep grazing by the Agricultural Research Service.

The Dillon area is one of the more popular sport fishing areas in the continental United States. The area attracts non-resident and resident fishermen throughout the year. Trophy fishing is popular, especially on the Big Hole and Beaverhead Rivers. Sport fishing has an economic impact to the area because of the equipment purchased, lodging, food, and guide service. Protection of the fisheries resource receives close attention of the Montana Department of Fish and Game. The BLM has intensified fisheries habitat inventories in the past few years which will provide important baseline data for future habitat alteration proposals.

PREHISTORIC AND HISTORIC FEATURES

Little has been done to inventory the prehistoric and historic features in the Dillon SYU. The July 1975 edition of the Montana Historic Sites Compendium lists 95 historic sites and 220 archaeological sites that have been identified in the six counties covered by the Dillon SYU. The compendium also rates the future potential for locating additional sites as "high."

The archaeological sites located in the Dillon SYU have the potential of yielding significant information on the habitation, adaptation, and changes of man since about 10,000 years ago. The SYU area is an area of major contact between two archaeologically defined cultural regions, the Northwest Plains and the Interior Plateau. Diverse environment was essential for the subsistence of these aboriginal populations. Archaeological sites located in a forest setting are an integral part of the economic lifeway study of these early Americans.

The potential for location of historic values is also great. The Dillon SYU is in the center of most early historic activity in Montana, especially mining, ranching, and commerce. Remains of old cabins, mining camps, and wagon roads are a few of the values expected to be located within the area.

Although there are no sites within the Dillon SYU presently listed on the National Register of Historic Places, it is expected that candidates for this register will be located as the area is inventoried. A statement on specific archaeological and historic values will be included in the EAR process for individual timber sales.

RECREATION

Because of the variety of forest areas included in the timber management plan, discussion in this section is necessarily general. EARs on individual timber sales will identify specific landscape types and analyze the influence of the proposed actions on existing landscape harmony and accentuation.

The areas included in the timber management plan are primarily forest types, including the ponderosa pine, Douglas fir, and subalpine fir series. The character of a particular landscape depends on the species and age composition of the stands, the expanse of the view, the steepness or ruggedness of the associated mountains, the presence of other associated features (streams, cliffs, rock formations), and the extent of human intrusions (logging, agriculture, mining, urbanization). Adjectives describing many of the landscape types include inspiring, rugged, and vast. Other landscapes are subtle, moody, and fragile.

The landscapes of the areas in question are generally harmonious. That is, their various features tend to relate to each other in an orderly and pleasing manner. Some views include accentuating elements (streams, ponds, rock outcrops, etc.) which heighten landscape quality by contrast. In some areas, intrusions in the form of roads, residential areas, logging operations, and powerlines reduce the quality of landscape character from the point-of-view of most observers.

The areas included in the timber management plan encompass many forms of recreation and recreational opportunities which depend on the visual attraction. Unidentified, undeveloped campsites can be found in many areas throughout the resource area and within the SYU.

Twenty-two (22) recreation development opportunities have been identified through URA Step 4. These unique recreation resources within the Dillon SYU include but are not limited to:

A. Three designated primitive areas
    1. Beartrap
    2. Centennial
    3. Humbug Spires
B. Natural Area
    1. Axolotl Lakes
C. Historical
    1. Lewis and Clark trail
    2. Road Agents Rock
    3. Stage routes
    4. Ghost towns
D. Geological
    1. Pipe Organ
    2. Humbug Spires
    3. Ringing Rocks
E. Archaeological
    1. Wickiups
    2. Quarry sites
    3. Pictographs
    4. Tipi rings
    5. Buffalo jumps
    6. Battle sites
    7. Caves and rock shelters
    8. Habitation sites
    9. Vision quests
F. Zoological
    1. Wild horse herds
G. Rivers
    1. Ruby
    2. Madison
    3. Big Hole

H. Reservoirs

    1. Ruby

    2. Lima

I. Botanical

    1. Ponderosa stand near Melrose

The three (3) designated primitive areas, totaling 32,457 acres, plus eight (8) undesignated areas, totaling 98,260 acres, which meet the criteria of "roadless", will be subjected to the Wilderness review procedures as set forth in the Federal Land Policy and Management Act of 1976. This totals 125,717 acres, not all of which is forested.

SOCIO-ECONOMIC CONDITIONS

Data presented in this section is from the BLM Socio-Economic Profile for southwestern Montana Regions 8 and 12; the Socio-Economic Overview, Beaverhead National Forest; and a descriptive analysis of Montana's Forest Resources, USDA Forest Service Resource Bulletin INT-11, 1975. The Dillon SYU counties have generally decreased in population since 1940. Only two counties, Beaverhead and Jefferson, increased in population during the period from 1960 to 1970.

Total Population and Percentage Change: 1950, 1960, 1970

	1950	1940-50 % Change	1960	1950-60 % Change	1970	1960-70 % Change
Broadwater	2,922	-15.3	2,804	- 4.0	2,526	- 9.9
Jefferson	4,014	-13.9	4,297	7.1	5,238	21.9
Beaverhead	6,671	- 3.9	7,194	7.8	8,187	13.8
Madison	5,998	-17.8	5,211	-13.1	5,014	- 3.8
Silver Bow	48,422	- 9.0	46,454	- 4.1	41,981	- 9.6

Source: USDC Bureau of the Census, Census of Population: 1940, 1950. Vol. II, Characteristics of the Population, Part 28, Montana.

USDC Bureau of the Census, Census of Population: 1960, 1970. Vol. I, Characteristics of the Population, Part 28, Montana.

Per capita personal income for the area has been consistently below the national average. Median family income in the United States (9,586.in 1969) exceeds median family income in Montana by $1,064. Dillon SYU median family incomes, 1969, were as follows:

Median Family Income: 1969

	Median Family Income	State Deviation
MONTANA	$8,512	--
Broadwater	7,038	-1,474
Jefferson	8,525	13
Madison	6,783	-1,729
Silver Bow	8,671	159
Beaverhead	7,923	- 589

Source: USDC Bureau of the Census, Census of Population: 1970. Vol. I, Characteristics of the Population, Part 28, Montana, 1972.

Rates of unemployment among civilian workers has increase significantly in most counties of the region. These figures have flucturated from below 5 percent to over 13 percent on a county by county basis.

As improved technology is applied to the wood products industry, present employment may decline unless existing harvest levels are increased or increased intensity of processing within Montana will permit the wood products sector to continue to grow.

Total employment trends for the area covered by this SYU have been generally downward.

Figures on the number of people employed in the timber industry for the SYU are not available. They are usually lumped together with agriculture. In Beaverhead and Madison Counties in 1970, these groups comprised 30.8 percent of total employment.

The average lumber index price for calendar year '75 was $119.16[1] for lodgepole pine and $134.88 for Douglas fir. For simplification, this is an average of about $125.00/MM bd. ft. This amount ($125.00/MM bd. ft.) times 5.46 MM bd. ft. yields a net worth at the lumber outlet of $682,500.

Some information on attitude and expectations specifically about industry and timber management within the SYU or portions thereof is available from a study by the State of Montana, Department of Natural Resources and Conservation, Energy Planning Division (Montana Energy Survey, unpublished, Helena, Montana, November 1974). This survey made several statements to which those interviewed were asked to respond. Three of these statements were: (1) The industrial development of Montana should be encouraged; (2) If new industry is to be built in Montana, it should be directed to areas in the state that are already industrialized; and (3) In order to live in Montana, I am willing to pass by opportunities for higher income that might be earned elsewhere. Each respondent was asked to indicate whether he strongly agreed, agreed, was neutral, disagreed, or strongly disagreed with each statement. The results of this survey may be found on the following page.

1. Source: Western Wood Products Association, "Lumber Price Trends," March 3, 1972.

PUBLIC ATTITUDES: 1974

The industrial development of Montana should be encouraged.

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Montana (N=909)	13%	29%	16%	25%	17%
Region 8 (N= 58)	10%	19%	21%	36%	14%
Region 12 (N= 57)	21%	32%	18%	14%	16%

If new industry is to be built in Montana, it should be directed to areas of the state that are already industrialized.

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Montana (N=893)	17%	34%	17%	27%	5%
Region 8 (N= 56)	20%	38%	21%	16%	5%
Region 12 (N= 57)	19%	26%	18%	32%	5%

In order to live in Montana, I am willing to pass by opportunities for higher income that might be earned elsewhere.

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Montana (N=898)	39%	37%	8%	12%	4%
Region 8 (N= 58)	45%	33%	5%	10%	7%
Region 12 (N= 58)	38%	40%	7%	14%	2%

Region 8 = Broadwater, Jefferson and Lewis & Clark counties

Region 12 = Beaverhead, Deer Lodge, Granite, Madision, Powell and Silver Bow counties.

Source: State of Montana, Energy Planning Division, Department of Natural Resources and Conservation, Montana Energy Survey, unpublished material, (Helena, Montana; November, 1974).

The SYU provides the setting for a wide variety of recreational experiences and opportunities. Recreational use on these lands range from leisure pursuits in a primitive environment to more structured activities in a historical setting. Lands within the SYU are nationally reknowned for big game hunting, fishing, and general outdoor vacationing. Much of the area is accessible by road, but some of the most scenic roadless areas in the state are also to be found within the perimeter.

LAND USE

Current land uses of forest lands on the Dillon SYU include, but are not limited to, livestock production, mining, camping, fishing, hunting, timber harvesting, and sightseeing. In general, these uses are compatible with one another when conducted in moderation. They must be analyzed carefully on a site-by-site basis as a forest management program is developed.

The BLM lands are intermingled with numerous large and small private landowners as well as large blocks of publicly owned lands, primarily Forest Service and State of Montana. There are some recreational subdivision developments scattered throughout the SYU which may influence forest management.

It will be important to coordinate our land use plans with adjacent landowners in the future. There will be some degree of stability to land use plans now being developed on the national forests, however, changes in direction management thrust on a national level or changes in private land use can quickly alter our plans on a site-by-site basis.

ECOLOGY

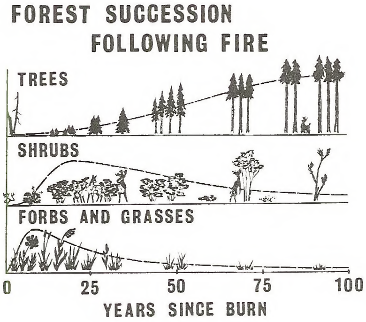
"Ecosystem" is a biological term applied to an area or unit of nature which includes both living organisms and non-living substances. Within the ecosystem, interactions occur that produce an exchange of materials between living and non-living. Natural ecosystems consist of four major components: (1) abiotic - water, carbon dioxide, nutrients, oxygen; (2) producers - green plants of all kinds; (3) consumers - large and small animals, insects; and (4) decomposers - primarily fungi and bacteria in upper soil.

Through the harvest of forest products, man is a major consumer in the forest ecosystem.

The forests of the Dillon SYU compose a complicated ecosystem in that they are composed of many plant species both large and small, numerous animals, and many fungi and bacteria. When these forests reach "climax" (evolved over a considerable period of time until a stable stage is reached), they become relatively unproductive. A climax forest is highly conservative of plant nutrients. Most food and oxygen it produces is used to sustain itself. In fact, there may be no net wood growth because of tree decay and mortality.

Through time, many of these climax forests were periodically burned over and began a new succession of plant species succession. The forests of the Dillon SYU as we know them today are a product of these fires. The exclusions of wildfire from these lands has altered the future succession of plants often to the detriment of wildlife species which prefer seral habitats, fiber production, nutrient release, and a host of other ecosystem processes. Timber harvesting can, to some extent, duplicate the changes brought about by fire through silvicultural practices. The successional sequence

shown below can be extrapolated to cover the disturbance caused by timber harvest.



The exclusion of fire from the ecosystem of the Dillon SYU has contributed to two serious insect problems presently plaguing the area. These are the spruce budworm and mountain pine beetle. With or without logging, major changes in plant species composition and condition will occur. In undertaking any kind of land management practices (including "no action"), the tradeoffs must be evaluated carefully. A forest management program is no exception. It can alter soil erosion, water supply, water quality, wildlife habitat, aesthetics, air quality, air temperature, and wind velocity. It can do so to their betterment or detriment of the components in their relationship with one another.

CHAPTER 3

ENVIRONMENTAL IMPACTS

This section analyzes the effects of the various means which may be employed to execute the proposed action. Documentation of the rationale for selection of certain measures and practices for a specific proposed action will be found in the environmental assessment prepared for that particular proposal.

An aspect covered by this document is the general cumulative impact of the many, relatively small actions that in total comprise the timber management program. Many of the discrete actions taken over a 10-year period may have a negligible impact. Where the general assessment does not cover specifies of a given timber sale, etc., they will be covered in supplemental assessment reports.

CLIMATE AND AIR QUALITY

Forest regions are products of the general climate of the earth, over which man has no real control. However, to the extent that man can destroy or conserve forests, he does control some local climatic factors. Viewed in this light, the forests assume much greater social significance than they would have if thought of solely as an economic resource.

The climate in which a given tree or stand lives may be entirely different from the regional micro-climate. In recent years, much has been learned about the micro-climate -- the climate near the ground, surrounding the trees. Timber management activities can impact the micro-climate.

Depending upon the extent to which they open the forest canopy, all cutting practices affect the micro-climate. The impact may be insignificant (light selection cutting), moderate (intermediate shelterwood cutting or commercial thinning), or great (extensive clearcutting). To varying degrees, each type of cutting increases solar intensity, air and soil temperatures, surface evaporation, and air movement and wind velocity; and decreases vegetative transpiration and relative humidity.

Reactions of the forest ecosystem to climatic changes are variable. Increased sunlight stimulates the sprouting and growth of branches on stems of trees; higher soil temperatures and more available soil moisture may accelerate tree growth; increased wind velocities may cause windthrow of reserved trees in a partially cut area or along the edge of a clearcut. Micro-climatic changes produced by canopy reduction can either favor or inhabit forest regeneration.

There may be short term emissions of pollutants from the engines of machines, and dust from yarding operations, which affect air quality slightly.

To the extent that yarding systems drag logs and otherwise disturb the understory vegetation, they may severely affect micro-climatic conditions of the plants and small animals that inhabit the specific areas of disturbance.

Right-of-way clearing for forest roads has impacts upon the local climate which are similar to those of clearcutting. Several of the road construction activities can cause temporary degradation of air quality by emission of engine exhaust fumes and particulate matter. Dust from construction operations may be locally heavy; its effect may be accentuated by increased movement of air and higher wind velocities in the corridors created by clearing. Transportation of logs by truck can degrade air quality along a forest road for short periods.

Methods of slash disposal, other than burning, have virtually no impact on air quality. Controlled burning, like wildfire, creates smoke. Much of the organic matter in smoke from forest fuels is similar to material naturally entering the atmosphere from living vegetation or from the decomposition of vegetative material. Research indicates that toxic compounds released into the air by burning forest fuels are negligible. There is no evidence that the combustion products of burning forest residue cause permanent injury to human health. These impacts usually occur in the fall during a two-month period.

Controlled burning can affect the local forest climate. The effect of a light burn, confined to the forest floor or slash piles might be locally significant but not extensively so. A hot fire, particularly a crown fire, can kill all vegetation, consume the organic material on the forest floor, and have severe impacts on micro-climate.

Reforestation by seeding and planting affect the micro-climate gradually, until crown closure is achieved and the forest canopy is continuous.

Significant changes trees make in climate and air quality are:

1. The mean maximum monthly air temperature in the forest will be several degrees lower than it was in the open.

2. Forest soil temperatures will be slightly warmer in winter and 5° F. to 9° F. cooler in summer than in the open and freezing of forest soil, if any, will be less deep than in the open.

3. Relative humidity of the air within the forest will be 3 to 12 percent greater than in the open, and evaporation of moisture from the forest floor will be much less than from soil surfaces in the open.

4. Wind velocities within the forest would be much lower than those in the open. A wind of 30 miles per hour would be reduced to as little as 5 miles per hour in a dense forest.

5. Trees are very effective in intercepting dust particles and filtering them from the air.

SOILS AND GEOLOGY

As a result of any cutting practice, organic material will be added to the forest floor more quickly than it would naturally, barring catastrophic windstorms, etc. There will be a temporary reduction of soil nitrogen for plant growth because of this addition. The added material will afford more protection from raindrop erosion. Clearcutting and seed tree cuttings expose more of the soil to erosion forces than the other cutting practices.

The effects of yarding systems upon the soil are interrelated functions of soil types, equipment, weather, and topography. For example, a soil may be severely damaged by crawler tractor logging during times of soil wetness. But the same soils may not be harmed if the same operation is conducted when the soil is frozen and protected by snow cover. The hazard of soil sterilization in small areas from fuel or oil dumping and spills is always present when motorized equipment is employed.

Aerial yarding systems generally have the least impact upon the soil; however, they have not yet been used in the SYU. Impacts include road and landing construction, which can initiate soil erosion and sometimes landslides.

Yarding methods which generally have moderate impact upon the soil are horse skidding, rubber tired skidder, jammer yarding, and mobile yarder-loader operations. These methods require more roads and landings than aerial systems. They also disturb a larger percentage of the litter layer and topsoil. Trails where the logs are skidded become scraped and compacted. These two conditions concentrate water and provide areas for overland flow of water which can lead to rill and gully erosion.

Yarding methods which generally have a more severe impact upon the soil are the crawler tractor and shovel yarding. Soil structure is usually destroyed and compaction results on frequently traversed areas. This is more prevalent if soil moisture content is high. Surface runoff is the rule under these conditions.

Tractor yarding causes more deep soil disturbance than moving cable yarding. Cable yarding causes more shallow soil disturbance than tractor yarding but has less overall (deep and shallow) soil impact. Shovel yarding, which is seldom if ever, used now on BLM timber sales, requires a dense road network. Many more acres are exposed to erosive forces utilizing shovel yarding rather than yarding methods listed as having slight and moderate impacts.

Clearing and grubbing for transportation systems opens an area, removes the vegetation, and disturbs and exposes the soil to erosive elements. It can cause soil compaction, particularly on moist soils, and accelerated erosion.

The excavation of earth or rock from its natural resting place has several impacts on the soil resource. It alters the natural drainage from hillsides and exposes underlying soils to weathering action. It removes lateral support to adjacent material. On hillside cuts, overburden removal on a slope at a critical point can trigger landslides. Roadside cut slopes are bare, erodible watersheds which can increase sediment and drainage problems. Topsoil may be poorly disposed of or wasted.

Fills add weight to the underlying soil mass, and on steep hillsides can trigger landslides or slip failures. Added weight of fill on faulty foundations can result in slumps and settlements. Newly constructed fills have bare slopes which contribute to erosion and sediment until stabilized. Fills placed at a greater angle than the normal angle of repose are prone to failures.

Grading operations impact soils by cutting, smoothing, and disturbing surface materials on roads, fill slopes, cut slopes, ditches, and other areas requiring shaping. These operations can cause erosion and sedimentation.

Topsoiling and seed bed preparation by tillage and discing loosens and disturbs the soil so that it may be easily eroded prior to turf establishment. Shoulders, fill slopes, slopes of ditches, drainageways, areas around drainage structures, cut slopes, other areas outside the rounded tops of cuts and toes of fills are potential erosion sources.

Ditch and fill slope erosion may occur. This erosion may result in the loss of productive soils, the clogging of ditches and drainage structures, and endanger the stability of side slopes in embankments and cut sections. Spillage of petroleum products or excess application may result in soil contamination.

Debris and slide removal practices impact the soil resource, depending on the method of removal (sidecast or removal to designated waste areas) and the location (stable or unstable) in which these materials are placed. Improper actions in removal and in relocating these materials makes them prime sources of material for soil erosion and stream sedimentation. Spoil may travel or creep downhill if steep slope gradients are involved.

While most actions related to timber management would have little, if any, adverse effects on geologic features, road construction could severely impact them. For instance, excavation of earth and rock during road construction and logging in the Curry, Bean, Jones, and Price Creek drainages of the Centennial Mountains has caused landslips and massive slumps.

A hot slash burn can consume the organic duff, slash, and brush, which still provide some shade for the forest floor, and thus expose the mineral soil to direct solar radiation. In some ecosystems, the result may produce a well-stocked stand of tree seedlings. In others, high surface temperatures or deficient moisture may inhabit the establishment of tree seedlings.

Burying slash causes soils to be exposed to erosive agents when the litter is removed. The wasted soil will also ravel or creep downhill if a steep slope gradient is involved. Chipping slash and spreading it back over the land will give additional litter cover and cause a temporary reduction in available soil nitrogen. Chipper equipment may cause soil compaction.

Scarification disturbs the protective litter layer and churns up the topsoil. These actions expose the topsoil to raindrop splash erosion and subsequent soil creep. Compaction of the soil, which reduces productivity, will result if scarification is done when the soil is at a high moisture content.

Area burning causes changes in available plant nutrients from the soil nutrient cycle. Intense burning the organic matter also bakes the soil surface, reduces its ability to absorb water, and causes surface water runoff and erosion.

Spot burning intensifies the conditions outlined under area burning, sometimes to the point of soil sterility which lasts for a number of years.

Seeding and planting will protect the soils from erosion. Thinning results in an increase of slash on the forest floor, causes a temporary suppression of available soil nitrogen as it decomposes, and increases the potential intensity and rate of spread of wildfire.

The use of retardants to suppress fires is not detrimental unless there is a high proportion of an element such as boron. Tractor constructed fire lines expose the soil to erosion forces. Lines running up and down the slope expose the soil to conditions which will cause erosion.

WATER

Right-of-way clearing for roads at creek crossings will expose natural water surfaces to continuous, direct solar radiation along short segments of streams. Direct solar radiation provides much of the energy required to raise water temperatures. However, this impact is not significant if it is limited to short segments of streams.

Clearcutting may cause sedimentation. The impact can be increased when broadcast burning is used in combination with clearcutting. Clearcutting and other timber harvesting methods may be beneficial in increasing the supply of water available for human use. Much research documents the potential of various cutting practices, properly applied, to increase water yields from forested watersheds significantly. Man-made openings in the forest canopy can cause the following effects, all of which result in increased runoff and more available water:

- increased accumulation of snow in openings;
- reduction of precipitation losses due to interception by the forest canopy and evaporation therefrom;
- reduction of soil moisture losses caused by transpiration of vegetative cover;
- increased water yield may cause a decrease in water quality, impact stream channels, and may cause flooding.

Falling and bucking of timber causes no degradation of water quality unless trees are felled into or across surface waters. Then, the lopping of limbs and sawing incidental to log making may deposit slash and organic debris in the water. This can cause the reduction of dissolved oxygen and impact aquatic life. Since it is required that all slash felled into streams be removed by hand, this impact is not significant.

All of the ground skidding and yarding methods have some potential for significant adverse impacts on water quality, since all cause some degree of soil disturbance. The effect is most pronounced when clear-cuttings are yarded by tractor, particularly on slopes of 15 percent or more and on saturated soils. The resulting disturbance exposed mineral soil to surface erosion, with consequent sedimentation and turbidity of surface waters caused by materials carried downslope in runoff.

Shovel yarding itself is no more destructive than mobile yarder-loader operations. However, the shorter reach of the shovel makes a denser network of parallel roads necessary for effective shovel operations. If the road system already exists, the shovel can be used without much soil disturbance. If new roads must be constructed to support the jammer or shovel operation, much soil will be disturbed, probably with severe impact on surface water quality.

In areas of steep terrain, landings for logs are sometimes constructed by excavating level places where none exist naturally. The excavation may expose large quantities of mineral soil to the impact of rainfall, with resulting ravelling of embankments and downslope movement of sediments with surface runoff into natural waters.

Studies have shown that road construction associated with logging, rather than logging itself, is the factor which causes greatest surface erosion and mass soil movement, with resulting degradation of water quality. All of the road construction activities which involve surface disturbance or movement of earth and rock can cause degradation of water quality. These activities include clearing and grubbing, excavation and embankment, installation of culverts, quarrying, and grading.

The adverse effects are greatest when roads are constructed on steep slopes (over 50%) and excavated materials are wasted by side-casting. The excavated materials may be carried downslope into

watercourses immediately by gravity or later by surface erosion or sliding and sloughing. Excavation for roads sometimes removes material which support unstable soils further unslope, with the result that the unstable soil mantle may later move downslope as a mass, sometimes damming a stream.

Construction of drainage ditches and bridges, and installation of gabions, etc., in stream channels can cause short term turbidity of streams while the work is being done. Contamination of water by grease, oil, and diesel fuel may also occur, if machinery used in these operations enters the water. Improperly installed culverts may discharge surface runoff onto fill slopes, eroding these slopes and carrying sediment into streams or lakes.

Forest access roads have traditionally been constructed adjacent to stream channels. In addition to those factors mentioned above, dust from passing traffic constitutes a source of sedimentation in streams.

Mechanical treatment of slash that involves the use of heavy equipment may result in soil disturbance and water pollution through erosion.

Broadcast burning can affect the quality of surface water. Hot slash fires that expose mineral soil to precipitation can result in surface erosion or mass wasting which, in turn, may cause sedimentation of forest streams. Severe burning can significantly increase sediment yields. The effect is emphasized on steep slopes in areas of heavy precipitation.

Sedimentation concentrations after hard burning may be many times greater than those observed on an undisturbed watershed. These abnormal sediment yields may persist for several years after burning, steadily declining as the exposed mineral soil becomes revegetated. Nitrate concentrations in stream water may increase following burning. Observations made so far would indicate that these concentrations will be

far less than the limit of 10 parts per million recommended for domestic use, and well below any level deemed harmful to aquatic life.

The effects of area burning on groundwater are less well documented. However, it is known that high fire temperatures at the soil surface reduce water infiltration rates by producing a non-wettable (water-resistant) layer of soil immediately under the surface. The water-repellant layer lies parallel to the soil surface, and may vary in thickness from 2 to 4 inches. The presence of this barrier means that only a thin surface soil layer is available to store and transmit water during a rainstorm. Consequently, even in relatively light showers, the surface layer quickly becomes saturated, producing excessive surface runoff and erosion and, of course, stream sedimentation. Generally, any practice which increases overland flow will reduce groundwater recharge.

The indiscriminate use of heavy equipment in scarification can cause sedimentation and turbidity of lakes and streams. The magnitude of this water quality degradation will vary directly with slope, amount of precipitation, instability of the soil mantle, and area and depth of soil disturbance.

To the extent that protection activities reduce the occurrence of fire, favorable impact on water temperature and sedimentation will result. Suppression activities involving the movement of heavy equipment and the construction of fire lanes expose soil and cause erosion which can pollute water systems. In the rare event that a road is built specifically for future suppression, impacts on water quality would be similar to those discussed above.

Insect control programs may affect water quality as well as aquatic plants and animals. Primary methods would be accidental direct spraying of insecticide into surface waters, runoff into streams from sprayed areas, and through percolation of chemicals into groundwater.

VEGETATION

Certain timber management practices may be employed which result in varying levels of removal of vegetation. The primary impact is on tree species. Such an impact (removal) may be considered short term since revegetation usually begins soon afterwards with regrowth of residual plant species and invasions by species adapted to open conditions (pioneer species). These pioneer species may be herbaceous or wood vegetation, including tree species, depending upon the local situation. Timber management practices also have long term impacts in the form of time necessary to complete development of a new forest that resembles the one (completely or partially) removed. Even when done under ideal circumstances, the process takes many years. On poor sites, the vegetation process may be very slow. Long term impacts are also reflected in changes in species composition.

The impact of the various cutting practices in the disruption, through tree harvesting, of the upper vegetal layer and partial damage to the lower vegetal layers in the course of felling operations. Clear-cutting or seed tree cutting produce cutting edges where standing trees are exposed to wind. Subsequently, windthrown trees may endanger adjacent vegetation by providing a breeding ground for insects or fuel for wildfire.

Impacts of selection cutting are the least of any of the final harvest cutting practices, since a relatively small amount of vegetation is destroyed or removed. Selection cutting does not normally increase danger to forest vegetation from wind, fire, or insects because of the absence of large openings or heavy concentrations of slash over large areas.

All harvesting has some impact on tree species composition. Generally, species in early successional stages are varied in a given habitat type. True climax plant communities will not be common. In shelterwood and selection cutting, tree selection which favors productive trees as a seed source may reduce the genetic variability of forest stands. With changing environmental conditions, this might increase the risk of mortality or cause a loss of stand productivity.

The impacts of commercial thinning and mortality salvage are relatively insignificant due to the minimal amounts of vegetation removed.

The short term impact of ground systems, such as tractor skidding, is the destruction or damage of undergrowth. Yarding can cause damage to residual trees resulting in rot, particularly in lodgepole pine and subalpine fir. Unless extensive soil compaction or loss of soil by erosion occurs, the long term impact will be to contribute to a relatively early natural regeneration of tree species. Logging methods, such as horse skidding, do not greatly impact the herbaceous and shrub layers.

Road construction practices have a severe impact on vegetation. In addition to the actual removal of vegetation from the area, road construction frequently destroys vegetation over extensive areas below the road cut or fill where sidecast material (soils, rocks) is pushed by tractors, dumped by trucks, or blasted by explosives. Land covered by sidecast is often slow to revegetate. Land covered by the road surface is permanently a non-producer of vegetation except for spur roads that are abandoned. Even the latter, however, will normally be incapable of producing vegetation similar to adjacent land due to their compacted condition. Dust from log hauling may adversely affect plant growth along roads.

Increased sediment from road construction and log yarding may create an environment conducive to aquatic plant growth. In other cases, if silt is heavy enough, it may kill oxygen producing aquatic plants.

The impact of the prescribed burning and mechanical treatment method of slash disposal are essentially the same as those of area burning and scarification discussed below.

The short term impact of scarification, mechanical brush cutting and area burning is a partial or complete destruction of vegetation. Spot burning of hand piled area, chipping of slash, hand clearing, cleaning of competing vegetation, mulching, and snag felling have negligible impacts on vegetation. None of the remaining forest development practices damage vegetation. Their short term impacts are related solely to reestablishment, growth, and protection of vegetation. These practices include tree improvement, tree seeding, tree planting, baiting, and fencing.

Development practices have long term impacts on the forest resource. Trees remaining after thinning are thrifty and fast growing trees will be regenerated early and grow at a fast rate, thereby developing a new forest without extensive delays. Some practices, however, may impact vegetation in the reverse of what is intended if misapplied. Examples include scarification that compacts soil, or removes soil or shrub layers that were providing conditions suitable for tree regenerations, and area burning that removes desirable shrub cover for tree regeneration, causes soil erosion or rapid invasion of other unwanted vegetation.

In general, adverse long term impacts from scarification and area burning are most likely to occur on relatively "warm-dry" sites within the ponderosa pine and Douglas fir series, especially where soils are shallow and coarse, and the humus layer is thin or absent. Long term adverse impacts may also result from use of heavy equipment on wet

soils, resulting in compaction. The possibility exists that tree improvement through genetics will produce trees that are over-specialized for rapid growth in a commercially desirable form, and under-specialized with regard to resistance to disease, drought, or other destructive agencies. Finally, tree planting or seeding can represent a tendency toward monoculture and the inherent instability of such ecosystems.

Protective measures benefit vegetation in the long term by insuring continuance of existing forest conditions. Fire line construction will destroy vegetation directly and also indirectly when excessive erosion occurs. Retardants have no significant adverse impact. Insect and disease control programs will have a beneficial impact on the growth of vegetation.

ANIMALS

1. Terrestrial Wildlife

Elk Development activities on forested lands appear to affect elk most directly (Coop. 1971; Kirsh, 1962 and Day, 1973). Since elk require rather extensive, undisturbed habitat free from agricultural development (Rasmussen, 1949), sudden and rather drastic modifications from activities such as logging and the associated roads can alter security levels to degrees which may be inadequate to hold elk under modified cover patterns, terrain, and hunter pressure. Increased access on an elk range is accentuated by increased road and trail development. Increased access increases motorized vehicle traffic resulting in disturbance which can be intolerable to elk.

Day (1973), reported elk use of clearcuts only when they were located within or near traditional summer range areas. Studies on 40 clearcut blocks revealed conditions most suitable for elk when the block was located the greatest distance from human disturbance, closest to extensive stands of timber cover, adequately treated for disposal of slash, and of younger age (2-10 years). The size of openings had negligible influence in comparison with security cover and disturbance.

Mule deer

Studies dealing with mule deer use of clearcuts including Day (1973) indicated that mule deer use increased as clearcuts aged (11-20 years). Older clearcuts provided a variety of browse in contrast to younger clearcuts which were predominately grass. Deer were also less selective than elk to clearcuts. They preferred cuts that were heavily laden with slash. These same slash

laden clearcuts were avoided by elk. Other studies (Reynolds, 1962, 1966) and Pearson (1968) have shown that deer use decreased following cleanup of slash.

Moose

Most logging in Montana is not generally located where it could potentially increase moose winter forage because of the elevational range above winter range (Schladweiler, 1974). Road development associated with logging can be detrimental if roads follow stream bottoms important to wintering moose (Schladweiler, 1974). The placement of roads along willow bottomlands would also increase human traffic (snowmobiles, etc.) resulting in increased harassment on moose.

Schladweiler reported that, based on the limited data currently available, clearcut logging in the spruce fir timber type on moose summer range appears to be detrimental to moose whereas clear-cutting in the lodgepole pine type can result in increased use by moose.

Blue grouse

Forest succession following selective logging in the absence of natural and controlled burning is probably necessary to maintain areas suitable for breeding habitat (Martinka, 1970). Selective logging would be designed to maintain conifer thickets of uneven age class stands from 20-60 years of age. Douglas fir (Pseudotsuga menziesii) is the most important coniferous species related to blue grouse habitat requirements. Blue grouse territory thickets are composed of this species, winter food for blue grouse is dominated by leaves of this species.

Clearcut logging in blocks of 10 to 40 acres could have beneficial relationships to blue grouse. This would open up

dense stands and would provide succession of Douglas fir toward thickets desirable for breeding habitat and territorial occupancy. Conversely, practices such as mistletoe control, spruce budworm control, terracing on clearcut areas and thinnning could have detrimental effects where blue grouse habitat is presently semi-open and optional.

Grizzly bear

The impacts of logging on grizzly bears in the unit is difficult to ascertain at the present time due to the paucity of quantitative data on present distribution, critical habitat requirement, survival, mortality, and present conflicts with man in the area. Areas essential to the grizzly's welfare must be determined through research and field investigations. Areas not essential to the grizzly must be determined and activities which cannot be tolerated must be identified.

Northern Rocky Mountain wolf

In order to determine the impacts of logging on the wolf, it will be necessary to conduct intensive studies of present wolf distribution, location of den sites, and determination of critical habitat. None of this information is currently available. Road development is of most concern as far as the wolf is concerned. The role of forested habitat for wolf security is not known. The impact of forestry practices upon the wolf's prey base (deer, elk, etc.) may be more significant than the direct impact of forestry practices.

Non-Game Species

The impact of logging on non-game species, is the most difficult to document due to the species diversity and the diversity of habitats in the area. Impacts on species should be monitored on a case-by-case basis. Noise and disturbance impacts can be high to these species although these impacts would be short-termed. Loss of snags and suitable nesting sites for cavity dwelling birds and animals would have a negative impact. As a general rule, for every species affected adversely by a forestry practice, another species may be benefitted. Emphasis must be placed upon documenting the impact of a proposed forestry practice upon a threatened, endangered, or "high priority" species.

Aquatic wildlife

The potential for adverse impacts on aquatic ecosystems is high. Since aquatic ecosystems are primarily products of watershed areas, anything affecting the watershed influences the aquatic ecosystem.

Soils, slope, weather patterns, geomorphology, plant communities, channel characteristics and many other factors influence the impacts of forestry practices on the aquatic system.

Generally, timber harvest affects a stream by: (1) increasing peak flow volume, (2) increasing exposure to solar radiation, (3) increasing the concentration of sediment and soil nutrients and, (4) increasing obstructions in the form of woody debris.

The magnitude of peak flow volume increase depends primarily upon the proportion of the watershed area logged and the silvicultural treatment method utilized. For instance, a clearcut unit may yield 10-20 percent more water than an untreated unit. The impact of increased peak flow volume depends primarily upon the natural resistivity of the stream to detachment of bank and

channel materials. Streams with low resistivity can be severely damaged, causing loss of trout cover, loss of fish spawning gravel, loss of riparian vegetation, and loss of benthic productivity through sedimentation or scouring by abrasive materials. Increased solar radiation can be beneficial in very cold headwaters, or detrimental by raising temperatures above optimal levels. Commonly, small tributary streams in the SYU are important as sources of cool water, when larger streams are subjected to excessive heating from various causes, streamside corridors, or buffer strips are effective in minimizing this impact.

Increases in sedimentation are detrimental. Sedimentation causes channel changes, loss of fish spawning gravel, reduction in invertebrate productivity, reduction of dissolved oxygen and increased water temperature. Nutrients from sediment (soil) may cause excessive aquatic plant production, leading to undesirable oxygen fluctuations.

Woody debris can reduce oxygen concentration, cause undesirable channel changes, bank erosion, and hinder fish movements and migrations. In some cases, a minor amount of debris may actually increase fish cover or pool area.

Road construction, maintenance, and use can be sources of sedimentation. Increased road access may increase fishing pressure excessively on small, unproductive headwater streams. Access roads, if properly constructed and stabilized, may provide needed access for fishing and hunting use.

Generally, new road construction, yarding, and skidding contribute an increased sediment load. The quantity and duration of impacts depend upon methods, design, slope, soils characteristics, and

rehabilitation and mitigating measures incorporated into the silvicultural plan.

Intensive habitat analyses have been completed on 22 streams. Channel stability and water quality baseline data are currently being gathered on 20 additional streams within Dillon SYU through contract with the University of Montana. Stream channel stability data will be gathered by BLM staff on an estimated 25 additional streams during the summer of 1977. Sediment and flow data are needed on many more perennial streams prior to completion of forestry management plans.

Invertebrate collections are an integral portion of many of the stream studies, and will aid the evaluation of silvicultural practices upon aquatic ecosystems.

PREHISTORIC AND HISTORIC FEATURES

Timber management operations can be very destructive to archaeological and historic sites and values, which are generally most valuable when they are undisturbed. These values consist not only of artifacts, features, structures, and other physical remains of the former inhabitant's activities but also they consist of the spatial relationship among these objects and with the surrounding environment. Soil disturbance on or around sites from such actions as road construction and site preparation will disturb these spatial relationships.

New and better roads into the areas of archaeological and historic values could provide easy access for vandals and looters. Unauthorized collection by participants in the timber management operations also adds to the loss of archaeological and historic values.

One beneficial impact of timber operation is that it will remove or alter ground cover which will reveal archaeological and historic values that would not be located otherwise.

RECREATION

With few exceptions, the impacts of timber management practices on landscape character are adverse. Impacts of greatest magnitude are visual; but sound, odor, and mood are also involved.

The harmonious element is most often impacted. Cutting areas are unnatural when viewed close up or at a distance if they do not resemble natural openings. The visual impact of roads is an important part of the general appearance of cutting areas. Cutting areas can provide some variety to a landscape which may be beneficial in the long term, if planned so as to blend naturally with the surrounding landscape.

Any action that produces a visible change in the natural forest environmental can cause an adverse human reaction. Among development actions with highly visible effects are prescribed burning of slash (atmospheric smoke, charred forest floor); scarification (dust during the operation, disturbance of surface vegetation and soil); and precommercial thinning (slash). Noticeable evidence of protection actions includes fire lines and, if identified as such, the burned areas.

Cutting practices, logging, and road building, are attracting increasingly critical public notice. The visual impact of clear-cutting is particularly severe. Some logging operations, and particularly subsidiary road construction, create visible soil disturbance and atmospheric dust.

Reaction to the unsightly effects of the timber management actions will vary in intensity with the individual viewer. The range of human attitudes does not lend itself to a discrete classification on a graduated scale. However, some interest group reactions can be considered generally typical:

-Members of a community dependent on a forest-based industry are more inclined to accept the adverse visual impacts of timber management actions.

-Hunters, fishermen, rockhounds, berry pickers, family type campers, and off-road vehicle enthusiasts tend to appreciate the easy access to the back country provided by logging road networks. This appreciation may or may not outweigh the individual's objections to unsightly conditions created for forest development and timber harvesting activities. Emotions may be mixed.

-Backpackers, wilderness advocates and some hunters and fishermen, usually prefer the forest environment in its original condition, without man-made modifications. These people may react most strongly to any unnatural change in the landscape. They often oppose proposed roads which would open back country areas to vehicular travel.

The adverse visual impacts of timber production are partially offset by some incidental visual benefits. Sometimes logging road construction opens up an impressive scenic vista which otherwise would not be appreciated. Clearcuttings and vegetative erosion control measures along roads produce forage which makes wildlife more available for easy viewing by amateur naturalists.

Sound, odor, and mood are also part of the landscape character. If given a choice of opportunities, campers would tend to avoid proximity to a noisy logging operation or mechanized forest development project. The noise and dust from such operations would be unpleasant to most recreationists. The combination of sound and odor could shatter the mood of the soul-seeking wilderness advocate.

Logging and roadbuilding may destroy or impair the visual value of geologic formations. In some cases, roads may expose geologic values of interest.

Damage potential to aesthetic resources by overuse, vandalism, etc., will be increased by construction of logging roads allowing access to heretofore relatively inaccessible country.

Areas identified as having significant recreation potential will be intensely inventoried prior to or at such time that an action is proposed for specific areas.

SOCIO - ECONOMIC CONDITIONS

While no significant adverse effects on employment at the national level are associated with the proposed action, its importance at the local level is significant. The market fluctuations in the timber industry do affect rates of employment, particularly in wood processing and manufacturing; however, this is not an explicit program impact. On the other hand, there are obvious beneficial effects on employment. Many jobs are created as a direct result of the timber management program. Other jobs, performing services for the timber related employees, are also created. In terms of the economy of western Montana, the impact of the proposed action is generally insignificant, due to the small volume involved in the program when compared to the total volume processed by the forest products industry. However, it may be very important to smaller mills and logging operators in smaller communities in the SYU. In setting a program level for a 10-year period with an indication of future harvest levels, there is a stabilizing impact concerning the unit's contribution to the timber industry.

The harvest and milling of one million board feet of timber requires the activities of about 8 persons/year. The proposed cut would employ about 44 people/year.

Of the estimated 44 new direct jobs created by the proposed action, it is reasonable to assume that 30 would be loggers and 14 would be sawmill workers. According to the Montana Employment Security Bureau (5-24-77), the hourly wage for these positions is loggers at $7.00 per hour and sawmill workers at $5.77 per hour. Assuming 2,080 work hours per year, the 30 new logger positions would generate ($14,560 each) $436,800 annually in direct income flow in the area. The 14 new millworker positions would generate ($12,000 each) $168,000 annually in direct income flow in the area. The total direct income flow would be $604,800 annually, which does not include any indirect income flow generated by indirect employment resulting from the proposed action. According to the U.S. Department of Commerce-Regional Economic

Information System, this $604,800 would represent 2.8% of the total 1974 personal income in Beaverhead County from all sources ($21,377,000).

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If total potential biological yield were harvested, approximately 96 jobs could be created in the logging-milling business, but loss of other values would no doubt offset this appreciably. Figures can be misleading--additional BLM volume could be a trade-off with private timber, which might otherwise be harvested, in which case the jobs would not be directly created.

The proposed timber management program will have little effect on mineral activities. To the contrary, mineral activities can pose a threat to the timber management program in that the mining laws allow prospecting in areas which have received intensive site preparation and reforestation.

Implementation of some of the proposed practices may restrict the use of PL to some grazing permittees and lessees, temporarily or permanently, e.g.:

Various cutting practices (particulary clearcutting) can create more livestock forage. However, grazing may conflict with the silvicultural objectives chosen for treated areas.

Roads built for log transportation may impair a livestock producers' full utilization of PL or of his own private lands. Log truck traffic can endanger domestic livestock. These roads

may become stock paths to otherwise inaccessible ranges which could benefit livestock but be detrimental to establishment of forest regeneration.

Short term or permanent losses of forage and other impairment of range livestock operations attributable to the timber management program are insignificant in the overall production of meat to satisfy national needs. However, these adverse impacts may be highly significant to the individual livestock producer.

Human health and safety can be affected by some forest development practices. Smoke from slash burning may have temporary adverse effects on people with respiratory problems. Visibility, at times, may be restricted where slash burning occurs near roads and highways, creating hazardous driving conditions. These conditions may also occur in conjunction with quarrying and rock crushing activities associated with road construction. Due to the minor overall size of the proposed action these risks are minimal.

Where logs are being hauled out of the forest, there is always the danger of increased traffic hazards to users of the logging roads.

Hazards to the health and safety of workers, both government and industry, can occur in practically all phases of the timber management program. Accidents leading to death and injury most commonly occur during harvesting and removal operations.

The proposed action will have a generally favorable impact on local public attitudes and expectations about BLM timber management. People expect an environmentally sound program and see the proposed practices as meeting that goal. Despite the general agreement, there will be specific actions proposed which will be disagreeable to some people.

The variety of recreational values and the broad array of timber management practices makes some land use conflicts inevitable. Although some recreational activities may be benefitted by the timber management program, others will not. Quite often a practice may be both beneficial and detrimental at the same time, the choice being dependent upon the user's point of view. As an example, for many years following logging, a cutting unit may have lost all apparent value to a camper or hiker. However, its invasion by vegetation may produce forage for wildlife, making the area attractive to hunters and berry pickers. As another example, surface runoff from a newly constructed, unstabilized forest road will cause varying amounts of turbidity and sedimentation of streams, with adverse effect of fishing success and water sports. The same road may provide access for hunters, berry pickers, rockhounds, bird watchers, campers, and prospectors.

Timber management practices may result in adverse public reaction, particularly in areas of heavy recreational pressure (usually near population centers); in situations involving unique or rare ecosystems or scenery; and where natural attributes create a high recreation potential.

LAND USE

Timber harvests can reduce the compatibility of timberland with adjoining land uses. For example, owners of summer homes may feel that the view from their homesites has deteriorated because of timber harvests. Campers may be disturbed by the noise and activity of an ongoing logging operation. This section should be given considerable thought in the analysis of impacts of individual timber sales.

Compatibility was considered and allowed for in the land use planning process. Subsequent development of adjacent private land for cabins, homesites, or other uses may create impacts on the BLM timber management programs. The BLM programs may not be compatible with new uses of adjoining private lands. Improper logging of adjacent land may adversely affect BLM forest management through watershed damage and increased hazards from fire, insects, and disease.

Since timber harvest, particularly clearcuts, change the character of the land, its suitability for certain activities can be affected. For example, removal of large old growth timber may render the area unsuitable for hiking and wilderness-type experiences while changing its value for water production and certain wildlife species.

Failure to consider individual site characteristics may result in application of practices that will be unsuccessful or reduce productivity on individual sites for timber and other values.

ECOLOGY

Logging and burning of the slash can temporarily impair watershed protection and increase overland flow of water and erosion of soil. Nutrient outflows will occur with this erosion and overland flow. Numerous studies including those reported by Debyle and Packer, 1972, in western Montana indicate that nutrient outflows represent only a small fraction of the nutrients available for plant growth. This increase of nutrients in the overland flow is not considered a hazard to water quality. These studies found that the nutrients and sediment in overland flow return to prelogging levels within two to five years after logging.

Timber harvest activities directly affect the nutrient cycling process by changing the amount of nutrients in storage. The nutrients stored in trees are, of course, lost from the site when the trees are removed. Besides carbon, oxygen, and nitrogen, calcium is the only other nutrient removed in any quantity. Carbon, oxygen, and nitrogen are also removed by burning vegetation. Calcium is the element lost in major quantities by the removal of logs. The magnitude of the impact on nutrient cycling is directly related to the severity of the harvest. Most studies reported involve only clearcutting. Fortunately, partial cutting would probably have negligible effects on nutrients outflows compared to clearcutting.

Successional patterns will be disrupted by timber management practices, especially harvest cutting. In the absence of disturbance, vegetative communities will move towards a climax plant association which will perpetuate itself. In an actual wild land condition, however, this tendency to move toward climax can be often interrupted by fire, insects, windthrow, etc. Those forested acres that will receive cultural treatments will be harvested as the stands reach maturity. Old growth stands over rotation age will not occur in the managed forest. Although we may be managing a climax species, the condition

of the forest will not be climax. However, by giving adequate recognition to the requirements of other ecosystem components such as through our snag management program, the adverse impacts of extensive timber management can be mitigated.

If the ecological relationships in undisturbed areas adjacent to treatment areas are in delicate balance, the relocation of animals or removal of vegetation may further extend the impact of the action. Therefore, the severity of the short term impact is not always localized to the directly affected area, but may extend to adjacent areas.

Generally, communities with high productivity in terms of the vegetal biomass can recover relatively rapidly. Communities with low productivity, i.e., plants with low growth rates and animals with low reproduction rates, are generally fragile and slow to recover. Consequently, the long term impacts of any of the development, protection, harvest, and transportation practices that destroy vegetation and/or cause extensive surface disturbance can be particularly severe on less productive sites.

While the physical impact of timber management practices on vegetation are readily visible, impacts on the micro-organisms that act as decomposers in the soil are indiscernible and perhaps more subtle. Nonetheless, they constitute a vital link in the nutrient exchange process. Their elimination or reduction due to chemicals or severe soil disturbance practices can also result in significant adverse short term impacts on the ecosystem.

Relative to the potential impact on the biotic components of the ecosystem, the impact of timber management practices on the atmospheric components of the physical environment are considerably less. Although

burning practices do release some particulates into the air, their impact is minimal in terms of human health. These particulates appear to have no lasting impact on the ecological relationships within the forest environment.

Even though the impact of any one practice on any one locale may be severe, its significance will probably be greatly diluted when viewed in the context of the size of the impacted locale in relationship to the size of the surrounding geographic area. Nonetheless, many practices are conducted in different parts of the forest at the same time, and in total can cause a severe cumulative impact to the ecosystem of the general area. Individual practices, including those having little adverse impact, continuously carried out over time can have a significant cumulative adverse impact on the ecosystem at some point in the future.

CHAPTER 4

MITIGATING OR ENHANCING MEASURES

Considering the diversity of specific sites involved in the action, the measures listed will be taken on individual forest management operations in the SYU. It is unlikely that all measures will apply to any one area, and subsequent evaluation of individual action may prescribe additional measures not considered in this level of analysis. The process of site specific management planning along with an EAR is an integral part of the timber management plan. It is the flow of measures from individual assessments into contracts for timber sale and forest development that best assures minimum residual impact.

CLIMATE AND AIR QUALITY

If the site is dry and exposed to solar radiation and drying winds, the cutting practices employed must provide shade which would reduce surface soil temperatures and evaporation. In forests susceptible to windthrow, cutting units should be designed so that strong winds would have minimum effect on the edges of the reserve stand exposed by harvesting.

The effect of right-of-way clearing upon the local climate can be reduced by keeping the width of clearing as narrow as possible, consistent with safety and adequate visibility. Dust arising from construction may be reduced to some extent by watering of subgrades during blading and surfacing operations. Dust from log hauling by truck can be abated by watering, oiling or surfacing them with a dust suppressant.

Smoke from burning slash will be mitigated by integrating burning schedules with weather reports to produce as fast and hot combustion as practicable and facilitate movement of smoke away from populated areas. Burying slash and chipping reduces the volume of fuel to be disposed of and thus reduces the need for burning and the resulting smoke emissions. However, both burying and chipping are rather costly measures and are not commonly employed, except for the burying of right-of-way slash which is becoming a more common practice. More intensive utilization of felled timber holds promise for future abatement of the smoke problem. In situations where prescribed burning of slash is essential, and considerable impacts from burning are anticipated, the following mitigating measures may be used:

- Adverse impacts will be reduced by keeping the areas to be treated small. The growing trends towards fewer and smaller size clearcuts and seed tree cuts favor this means of mitigation, particularly in the case of area burning. The beneficial effects of dead shade, where desired, will be retained by only spot burning slash concentrations that must be removed.

- If a light burn would achieve silvicultural objectives, its application can be timed for a period when burning conditions would favor an easily-controlled fire of low intensity.

- The climate through freezing and thawing has a mitigating effect on soil compaction and should be considered as a factor influencing healing of ground disturbances.

SOILS AND GEOLOGY

Clearcutting and, to a lesser degree, seed tree cutting practices shall not be carried out on slopes where the potential for excessive erosion or mass failure exists. Factors affecting slope stability which should be considered include slope gradient, thickness of the soil mantle, character of the underlying bed rock, precipitation patterns, and the inherent strength of the soil. When these factors appear critical, other cutting practices will be considered. When these other practices, such as selection, shelterwood, etc., are not feasible due to silvicultural, economic, or technical constraints or the fact that the potential hazard remains despite the system of cutting employed, the area will be exempted from commerical timber production. Geologic and erosion hazards will be inventoried as a part of compartment development planning.

Tractor logging will be limited to slopes with average gradients of less than 50 percent. Slopes of 55 percent and over have been removed from the harvest base and will only be restored when local logging methods are able to log them without environmental damage. Tractor skidding will be limited to those seasons and sites where soil moisture is low enough to avoid compaction, rutting, or gouging of the soil. Winter logging will be considered where advantageous to protection of soils. The SYU area is subject to periods of hard freezing conducive to winter logging. Rehabilitation of skid roads will be required. Operators will not be permitted to construct a skid road for one or two trees. Since shovel yarding requires a closely spaced network of roads (250 feet apart), adverse impacts can be reduced by confining these operations to existing road systems; i.e., if new roads must be constructed, alternative logging methods will be used. Landings will be located so as not to create excessive sidecast or slope stability problems. Landings on highly productive sites will be minimized. After use, ripping may be necessary to mitigate soil compaction, and the stockpiled material will be redistributed over the landing.

Road alignment and design have important effects on roadside erosion, and effective control must begin in the design phase, since the location of a road determines to a large degree the amounts of erosion which may occur. The selection of the road corridor provides the opportunity to place a road in favorable relationship to topography, drainageways, soils, other natural features, and prevent or anticipate man-made features in order to minimize the base erosion potential.

Clearing and grubbing limits will be marked so as to minimize the area of soil disturbance. Clearing and grubbing will not be carried out during periods of wet weather and high soil moisture conditions. Exposed surfaces on cut slopes will be minimized and ditch gradients will be flattened in order to reduce the number of cuts, thereby reducing erosion hazard. Borrow areas will have the topsoil stockpiled, be shaped to natural contours, have the topsoil redistributed, and be revegetated.

All fills higher than 30 feet will be designed in accordance with established principles of soil mechanics. Construction of embankments will be done in small lifts and compacted at optimum moisture, usually in the range of from 90 to 100 percent of standard maximum density, before applying the next lift. As a result, shear strength of the soil will be increased, permeability is decreased, and settlement of the embankment is minimized.

During earthwork operations, areas of bare soil will be shaped to minimize storm runoff erosion. Methods of control could include such devices as silt basins, sedimentation ponds, berms, and temporary down drains, swales, ditch pits, and brush barriers. Drainage channels will be constructed early in the grading operation.

Ditches will be kept cleared, culverts unplugged, and drainageways free of debris. Spur roads that are outsloped will be cross drained and have berms removed on the outside edge except those intentionally constructed for the protection of road grade fills. Before spring runoff

begins, all ice and snow berms created on winter haul roads will be removed. Gully erosion in waterways and ditch bottoms may be repaired by filling, shaping, and lining with riprap, etc.

Debris and slide material will be end-hauled and deposited on a safe bench or cover location well above the high water level. Disturbed areas will be shaped, tilled, and seeded with deep-rooting legumes and grasses to hold the soil in place and mulched, or some other stabilization practices used.

Drainage should never be allowed to dig its own channel. In preparing the road subgrade for surfacing, the material will be redistributed evenly, not scraped over the edge where it may erode into the established ditch. The road grade will be established at least 5 feet above the water overflow level in wet areas and areas subject to overflow.

The stabilization procedures for erosion prevention include grass seeding or hydro mulching of cut and fill slopes, borrow pits, landings and skid roads, with SCS approved seed mixtures suited for the locale. Due to the small size and scattered nature of these projects, the use of a hand operated broadcast seeder has proven the most suitable. The best time for broadcast seeding is either late fall or early spring while the site has a snow covering and as soon as possible after the disturbance has occurred. Some sites, like temporary road beds having compacted soils, need some form of mechanical site preparation to break up the compacted surface.

Erosion of the road surface will be minimized by performing proper maintenance grading and shaping and by patching and filling holes and irregularities. Mitigating measures as prescribed by the district programmatic road maintenance EAR will be taken.

Individual areas will be evaluated before and after logging to determine best method of slash control conducive to revegetation. If

adequate topsoil exists on road rights-of-way for example, it will be stockpiled and respread on the surface following use. Broadcast burning may be used occasionally where adequate slash exists to carry fire and concentrated piling would be damaging to soils.

Mechanical scarification for planting will be conducted when the soil is dry and limited to the area necessary to accomplish the task.

Fire lines will be constructed on the contour when feasible and subsequently water-barred and revegetated. The fire line can be scarified to loosen compacted soil if the line also served as a trail for vehicles.

WATER

The adverse effects of clearcutting and seed tree cutting on water quality will be mitigated by providing streamside buffer strips of adequate width and density to reduce or eliminate sediment laden overland flow from reaching stream channels. All perennial streams and those streams which carry water during peak runoff seasons will have buffer strips. Buffer strips will contain enough trees and shrubs to provide shade for the stream and protection for the streambank. The width of the buffer strip necessary to meet these objectives will consider the slope of the ground into the stream channel; topographic shading; tree height, density, and species; stream characteristics (width, depth, and flow velocity); erodibility of the soil; groundwater levels; and precipitation patterns.

If these factors are critical and the success of the buffer strip appears questionable in mitigating the impact of logging, other cutting practices will be considered.

It is extremely important that debris be removed from stream channels concurrent with logging. Channel clearance will not be deferred until just before the timber sale contract is terminated.

Felling timber upslope or along the contour of steep slopes will prevent felled trees from shooting downhill and into or through streamside buffer strips. If possible, trees cut selectively adjacent to natural waters will be felled directionally away from the water.

Areas adjacent to streams frequently are more fragile than adjacent slopes. Selected removal of timber in this zone will also dictate the proper yarding methods which might be different than the rest of the sale area. "Tractor" skidding is generally not acceptable; some other method that creates a minimum soil disturbance is needed. Tractor

skidding will not be permitted down or across any stream channel without a properly constructed crossing. Tractor skidding on all areas will be timed so that excessive soil compaction does not occur as a result of excess soil moisture.

Adverse impacts of road construction may be mitigated by several means.

1. Designing the roads to minimum dimensions for the proposed use, consistent with safety. If it is necessary to traverse short sections of unstable terrain, remedial measures (riprap, extra drainage, etc.) will be included in the road design.

2. Care will be exercised to protect stream channels and banks by streamside buffer strips wherever possible. In the case of roads which approach stream crossings in narrow canyons, the right-of-way clearing width may need reduction below the road to provide a vegetative strip for stream protection. The stream crossing itself will be as narrow as possible, consistent with traffic safety. The stream channel will never be used as a disposal site for excavated material from other portions of the road; often stream crossings become unacceptably wide because of this practice.

3. Endhauling the excavated material will avoid long sidecast fills in steep terrain. Disposal sites for endhauled material will be selected with care to avoid overloading slopes and causing mass failures. Fills will be compacted where this practice will contribute to slope stability and prevent road failures.

4. Culverts and bridges will be placed in natural drainageways as near as possible in line with the flow direction to enable a direct unimpeded entrance and exit for the intercepted water. Use of short, right-angle culverts will be avoided. Use of longer and

skewed culverts to follow the natural drainage pattern will result in less maintenance cost even though initial installation costs will be higher. Culverts will be installed at frequent intervals to assure that the road subgrade will remain dry and stable. Aprons will be installed on fills under culvert outfalls. Downspouts, or other suitable conductors, will be used to carry culvert drainage and to dissipate the kinetic energy of this water before this is allowed to run onto natural slopes.

5. Time the construction and installation of roads, bridges, and culverts so that the streamflow is optimum for completing the required work with minimum degradation of water quality. Stream banks and protective vegetation will be conserved.

6. Culvert ends and bridge abutment slopes which have received concentrated water flows will be stabilized and riprapped. In general, bridge repairs include deck, railings, expansion elements and footings, bulkheads, etc., the latter of which may require some work in the bed of a stream. Materials such as concrete, excess grout, form oil, etc., will not be wasted in the stream. Approach fills and banks will be stabilized to prevent erosion, and trash and debris will be removed at completion of bridge site repairs.

Stabilization practices are of two general types: (1) correction of an incipient failure of a road or slope and (2) reduction of erodibility of a road fill, slope, or road cut. These practices generally have beneficial impacts since a successful stabilization activity maintains or improves water quality.

The impact of area burning on water quality can be minimized by reducing the temperature of the burn, and by reducing overland flow from the burned area to the stream channel. Burning piles instead of broadcast burning will reduce the effect of burning on water infiltration.

Burning will be coordinated with weather conditions to reduce intensity of fire consistent with slash disposal objectives. Overland flows from fire lines may be reduced by waterbars or check dams along the fire line. Filter strips of undisturbed vegetation left along the bottom of the area burn will filter some of the suspended solids from overland flow. These filter strips also reduce the velocity of flow and cause deposition of sediment before it reaches the stream.

The adverse effects of scarification on water quality may be reduced by (1) keeping machinery out of stream channels, both perennial and intermittent, (2) avoiding areas where slope instability will be increased by the removal of shrubs, tree stumps, and roots; (3) avoiding the disruption of the normal distribution of water downslope; and (4) scarifying along contours. Care will be taken to leave enough small plants and plant debris to protect the soil from raindrop impact. Areas of thin soils which can be easily stripped from underlying bedrock will be avoided. Soils which have a high potential for compaction by heavy equipment even during the dry season will be excluded from scarification activities. Coarser textured soils will have scarification planned for seasons when the soil moisture is low enough to reduce soil compaction.

Proposals for the use of chemicals in forest insect control must be analyzed with regard to the impacts, mitigating measures, and economics concerning water as well as other environmental components. Consideration will be given to mitigating the potential for watershed pollution resulting from spraying in or adjacent to streams. The two most serious insect problems on which chemical control has been considered are for Western Spruce Budworm and Mountain Pine Beetle in the SYU. Control of these insects may best be accomplished through silvicultural methods. The probable use of approved chemicals (such as Sevin) is unlikely within the SYU.

VEGETATION

Mitigation of long term adverse impacts resulting from timber harvest practices is primarily a matter of insuring that the cutting practice used is one that would result in environmental conditions favorable to tree regeneration on the specific sites.

Proper layout of clearcut and seed tree units will mitigate most windthrow risk.

Windthrow is negligible in shelterwood cutting areas. The three-stage cutting process reduces velocity of wind currents, and wind firmness in leave trees also results after the first cutting cycle.

Proper selection of trees to be cut in shelterwood harvesting would improve the genetic composition of the regenerated stand. Foresters must keep the principles of applied genetics in mind when selecting trees for removal. This generally means improving quality while maintaining diversity. Although a successional stage preceding climax may be the management objective, proper practices would retain site productivity and the potential for plant succession to progress to a climax condition.

Adverse short term impacts resulting from destruction of vegetation by yarding systems will be mitigated by using only those methods that result in minimum disturbance to understory, shrub and herbaceous layers, e.g., mobile yarder, jammer, and horse yarding. However, mitigation of long term adverse impacts of various logging methods is, like development and cutting practices, a matter of insuring that resulting environmental conditions are favorable to tree regeneration on the specific sites. Winter logging can reduce damage to herbaceous vegetation where deemed necessary.

In general, impacts caused by road construction can be mitigated by locating and engineering roads so as to avoid sidecasting where possible.

Specific recommendations for mitigating adverse impacts on land are also applicable to mitigation of adverse impacts on vegetation.

Mitigating of adverse short term impacts as a result of forest development treatments that destroy existing vegetation may be achieved by confining practices to small areas of land, e.g., scarification in strips or patches, mechanical furrowing or trenching, spot burning, and hand clearing and cleaning. Long term impacts associated with forest development actions such as scarification and area burning will be mitigated by insuring that such actions result in environmental conditions favorable to tree regeneration of the specific site. This requires (1) an accurate appraisal of environmental conditions on the site prior to the action (this requirement may be met by classifying forest land according to habitat types), (2) applying forest development actions only to those sites that will respond to treatment, and (3) insuring that both considerations are incorporated into compartment development plans.

Mitigation is possible by limiting scarification and area burning to cool-moist sites, especially those on gentle slopes with deep, loam soils. The adverse genetic impact of tree improvement programs can be avoided by adhering to statistical and genetic guidelines relative to number of trees selected per breeding unit for breeding purposes. Monoculture can be mitigated by planting several species. Long term adverse impacts from fire can be mitigated by planting tree species soon after the fire. Short term adverse impacts can be mitigated by seeding a variety of herbaceous plant species soon after the fire.

Disturbed areas will be artificially revegetated when natural regeneration cannot be reasonably expected in a short period of time. Most of the practices associated with protection, i.e., insect, disease, and fire control, are in themselves mitigative since they are primarily

aimed at maintaining the health and vigor of the vegetal components of the forest.

The existence of endangered and threatened plants suspected to inhabit a compartment and/or proposed sale area will be determined and appropriate steps will be taken to insure their survival. No endangered plants have officially been identified on the SYU at this time, as defined by the Smithsonian Institute. Of other potentially endangered plants only *Penstemon lemhiensis* is presently worthy of "watch" status.

ANIMALS

Preliminary recommendations are presented regarding logging and the associated effects on wildlife. Since logging practices occur on such diverse habitat types and impact wildlife species in different degrees and at different times, there is no substitute for on-the-ground inspections, joint discussions involving wildlife biologists, the managers and other resource specialists and a complete knowledge of current research information and short and long-range management implications of the logging operations.

Where to log, when to log, roads and trails required for removal of timber, off-road closures, slash disposal, livestock grazing on the logged area, including the impacts of water development, must all be considered. The non-commercial values of wildlife must also be considered especially with the trend toward nature study, photography and backpacking experiences. The value of seeing an elk, for example in its natural environment rates high with this group of the public. There is no substitute for a careful and cautious attitude by the resource manager where wildlife values are involved. Greater public and other agency involvement is a mandate in the Federal Land Policy and Management Act of 1976 (PL 94-579) and must be considered on plans where logging will impact wildlife.

With the strong opposition and public sentiment against controlled burns and allowing natural burns, logging may provide a tool to improve habitat if carefully planned, monitored, and implemented with wildlife in mind as a goal rather than an afterthought. Effort should be made to implement objectives into logging plans under these circumstances.

A comprehensive ecological study involving logging and elk relationships have been underway since 1966. Of the study block areas, the Long Tom Creek area is located in the Dillon unit. The study area is located approximately 25 miles southwest of Butte on side drainages

adjacent to the Big Hole River near Wise River. Preliminary recommendations as a result of seven years of research are now available and will be utilized in future planning. Recommendations from this study are very applicable here since the responses of elk and elk use are evaluated prior to, as well as during and following logging. Logging activities in relation to elk become even more complex when we consider change in patterns of elk use in relation to various phases of the elk's life history such as feeding, calving, rutting, migration, and other influences such as hunting, motorized vehicle influence and livestock use.

1. Terrestrial Wildlife

Recommendations

A. Buffer strips of timber at least 2 chains in width (132 feet) will be left between any road and perennial stream. The same type of buffer area will be provided between any cutting unit and perennial stream.

B. Locate and construct all roads at the minimum standards which fit the topography, minimize disturbance and with as low a grade as possible sufficient for transporting timber from the site.

C. Road right-of-way slash will be disposed of. Standing undisturbed dense cover will be left adjacent to roads as feasible, based on field review and marking.

D. Roads will be evaluated for closure to vehicle use following logging. Roads will be considered to remain open for access to hunting areas, but closures will be considered where increased traffic would disrupt elk and other wildlife. Any closures will follow the procedures outlined for off-road vehicle regulations (Federal Register, Vol. 41, No. 146 and Title II of the Sikes Act).

E. Roads will be closely evaluated by a biologist during the pre-planning stage where construction is anticipated on moose range. Critical areas of concern include, but are not limited to stream bottoms important for wintering moose.

F. Slash cleanup will be accomplished on all clearcuts. Average slash depth will not exceed 1.5 feet in areas which are important to elk use.

G. Areas of heavy cover are important to wildlife when adjacent to clearcut areas. Careful evaluation of the effects of additional forest harvest on these areas is important and will be done.

H. Full consideration will be given to staggering the clear-cutting practices in at least five year intervals for any particular drainage rather than logging an entire drainage for any given year. This will minimize disturbance, and allow for natural succession of herbaceous cover desirable for elk (5-7 years), especially in lodgepole pine forested land and would provide escape cover during and immediately following logging.

I. Livestock grazing on clearcuts following logging will be evaluated and controlled where necessary. Development of livestock water to encourage livestock use of clearcuts will be evaluated by a biologist early in the pre-planning stage to avoid conflict with elk habitat management.

J. Moist, mesic sites interspersed with timber will be protected. These sites include, but are not limited to heads of drainages bordering streams, bogs and marshy meadows, and mesic benches. These sites are an important component of elk summer range, especially when interspersed with various timber types and densities. The succulent vegetation available on these sites are readily utilized by elk.

K. Logging will be evaluated early in the planning stage where winter range is involved. Cutting will not be allowed during the potential conflict period of December-April. Cutting will not be allowed where the maintenance of timber cover is necessary for elk, moose and mule deer.

L. In view of the fact that critical habitat for both the grizzly bear and the Northern Rocky Mountain Wolf is yet to be determined, actions will be taken to preserve these areas as they are determined. This may make it necessary to delay or cancel logging plans which may impact these species. More comprehensive studies are necessary in order to make these determinations. Consult with Montana Department of Fish and Game, U.S. Forest Service, National Park Service, and U.S. Fish and Wildlife Service, also concerned with the welfare of these species.

   Emphasis should be placed on the following: (a) Identify areas that are critical to the survival of bear and Rocky Mountain wolf which should not be subject to human disturbance brought about through logging practices.

   (b) A determination should be made of activities which can and cannot be tolerated by these species.

M. Snags and deadfalls will be considered for wildlife use on cutting areas on a case-by-case basis. Leaving snags in this case may enhance or reduce impacts on non-game species associated with the forest areas.

2. <u>Aquatic Wildlife</u>

<u>Recommendations</u>

Mitigating measures will be designed to prevent deterioration of in-stream and riparian vegetation which provide food production, cover, and reproduction of fish and other aquatic organisms. Any impact on stream habitat must comply with State and Federal water quality standards. The following recommendations will be followed

regarding protection of in-stream and riparian vegetation:

A. Road and trail construction proposals will be evaluated early in the planning stage to eliminate deficiencies in construction, maintenance, and timber harvest which, in aggregate, constitute unacceptable damage to water quality and aquatic habitat.

B. To assure meeting quality standards, personnel of the Montana Department of Fish and Game will be consulted on all proposals for road development where alteration of fisheries habitat could be expected.

C. Riparian vegetation will be given a high level of protection sufficient to maintain natural stream temperatures or comply with state water quality standards. Where degradation is anticipated, or damage is inevitable, full consideration will be given to alternate routes or modification of the proposal.

PREHISTORIC AND HISTORIC FEATURES

Areas subject to timber management activities will be inventoried and archaeological and historic values identified will be discussed as part of the existing environment of each individual timber sale. Impact to these values will be avoided when feasible. When avoidance is not feasible, impacts will be mitigated. Mitigation will include documentation, surface collection, excavation, and relocation, depending upon the scientific or heritage potential of the values.

Cultural resources that are on, or eligible for nomination to, the National Register of Historic Places shall not be subjected to any timber management activity which may have an effect upon the site without first providing the Advisory Council on historic preservation a reasonable opportunity for comment.

When necessary contracts will include stipulations designed to prevent the inadvertent destruction or alteration of known cultural resources and all contracts will have the following provision to protect resources not previously recognized:

Cultural Resource Protection

If in connection with operations under this contract the Purchaser, his contractors, subcontractors, or the employees of any of them, discovers, encounters or becomes aware of any objects or sites of cultural value on the contract area such as historical or prehistorical ruins, graves or grave markers, fossils, or artifacts, the Purchaser shall immediately suspend all operations in the vicinity of the cultural value and notify the Authorized Officer of the findings. Operations may resume at the discovery site upon receipt of written instructions and authorization by the Authorized Officer.

RECREATION

A primary mitigating influence is the Bureau Planning System, whereby areas of outstanding scenic quality or human interest value are identified and excluded from the timber management program or receive modified management to preserve these values.

Visual impacts will be reduced by several measures. The appearance of smoke in the atmosphere from area and spot burning of slash will be minimized by smoke management technology. This involves the coordinated effort of meteorologists and public and private forestry agencies to integrate burning schedules with weather reports so as to produce rapid fuel combustion and quick dispersal of smoke into the upper atmosphere. Alternative slash disposal measures which create no smoke may be feasible, e.g., chipping or burying of slash.

Atmospheric dust from road construction operations may be somewhat reduced by watering of subgrades during blading and surfacing operations. Dust from log hauling by truck can be abated by oiling roads. Periodic application of water or other dust suppressants to dirt or gravel surfaced roads also reduces the problem.

The visual impact of cutting practices and logging operations will be mitigated by various means. Shelterwood cutting has much less impact than clearcutting. Particularly in sensitive areas, use of continuous canopy cutting methods is required. One concept employs a system of modified shelterwood cutting which defers final removal of the forest overstory (dominant trees) until understory regeneration is large enough to present a forest-like appearance.

Clear, cool streams of high water quality are scattered through the district. The visual impact of turbid, muddy, or debris-filled streams reduces the observers' experience level. All operations will be designed to protect the water quality and stay within State standards of turbidity.

The adverse psychological effects created by highly visible timber management activities can be greatly reduced by skillful, perceptive use of landscape management techniques.

Landscape management techniques have various applications. On gentle terrain, a roadside buffer strip of uncut trees and undisturbed ground cover may be reserved to screen aesthetically unpleasant activity in foreground distance and middle ground distance zones from the view of sightseers.

Where clearcut areas will be visible in middle ground distance and background distance zones, negative effects will be mitigated by avoiding straight cutting edges and square or rectangular shapes, by locating cutting lines along contours so as to conform with topography, by blending cutting lines into natural vegetative features, by keeping middle ground clearcuts small, etc. The BLM's visual resource management system will be used to reduce the unsightliness of scars on the landscape and unnatural openings created by timber management practices. The visual contrast rating will help to mitigate the visual impacts by determining which design element (form, line, color, and texture) is contributing to the greatest amount of visual contrast. Thus, by reducing the degree of contrast for any element, the overall contrast can also be reduced.

Probably a good deal of unfavorable public reaction to the aesthetic impacts of timber management exists because some people do not understand natural processes. If they can learn, for example, that the visual impact of a recent clearcutting is relatively temporary for that area because the managed forest is self-renewing, much ill feeling might be dispelled. The various news media offer some opportunities in this regard. So do outdoor classes for children of school age.

The high noise level produced by the engines of logging and construction equipment could probably be reduced by improved muffler systems, but so far as is known, there has been no effort in this direction.

Of those acres subject to wilderness review, 27,796 acres have been classified as productive forest land and been 100 percent restricted in the Timber Management Plan.

SOCIO-ECONOMIC CONDITIONS

If harvest levels can be uniform from year to year, they will be a stabilizing influence on the timber industry, particularly to the small mills and logging operators in outlying communities in the SYU. Occasional increased or decreased sales may be necessary to offset shortages or depressed markets. This ability is limited by the harvest volume proposed. Our program is designed around a 10 year plan so some harvest variation is permissible on a yearly basis as long as the total 10 year harvest is within proposed limits.

Effects on inhabitants caused by smoke from slash burning will be mitigated by burning on days when atmospheric conditions favor rapid rise and dispersal of smoke. Quarrying activities will not take place where inhabitants will be subjected to clouds of dust.

Safety hazards associated with log trucks and the motoring public will be mitigated by proper road design, avoidance of blind curves, providing adequate turnouts for passing, warning signs, and use of dust palliatives.

Accidents and injuries involving timber harvesting and management activities can be reduced by ensuring the employees receive adequate safety training, that they are thoroughly trained in their jobs, that they wear required safety equipment, and that they use the proper equipment, maintained in a good state of repair.

The objections of prospectors and mining claimants to timber management practices can sometimes be overcome by personal contact. Good communication with livestock producers can do much to alleviate conflicts between timber production and grazing. In most cases, timber management objectives can be met with deferment of grazing for seedling establishment rather than long-term withdrawal of an area from grazing.

ECOLOGY

The mitigative measures individually described for each component of the environment in this section represent, collectively, the actions which might be taken to maintain existing ecological relationships. Consequently, they are not restated in this part.

Many practices identified as part of the program are in themselves mitigative in preventing or restoring any ecological imbalances or damage incurred in the course of carrying out disruptive practices. These mitigative measures include such practices as seeding, planting, fencing, mulching, protection, etc. Usually, the disruptive practices are those associated with the cutting, yarding, and transportation phases of the program.

The effectiveness of mitigative measures generally would be most critical in preserving the natural balance in fragile areas of low productivity, and in aquatic ecosystems.

The effects of timber management on nutrient cycling are minimal when practices are applied properly. Nutrient losses occurring immediately after logging seldom extend beyond a year or two. Nutrients lost (calcium, nitrogen, etc.) are in abundant supply in forest ecosystems. Along with weathering of parent material and return with precipitation, a loss in productivity due to nutrient deficiencies is rare in Northern Rocky Mountain ecosystems.

In a wildland state without the disturbance of man, the ecological relationships between plants, animals, and their environment are constantly undergoing changes, some of which are rather drastic -- wildfire for example. Timber harvest may be used as a substitute for achieving objectives which previously were accomplished through "acts of God."

LAND USE

Periodic updating of land use plans will identify and resolve land use conflicts as private lands adjoining BLM commercial forest lands are developed. Timber management activities can be made more compatible by adjusting the timing and intensity.

Careful selection of cutting practices, road layout, and cutting areas can greatly reduce impacts on adjoining land. Better land use planning on private land will reduce the impact of development and logging on public lands.

This factor must be fully evaluated in considering the impacts of individual sales to be made in carrying out the timber management plan.

Periodic reconsideration of land use planning resource allocation is necessary. All compartment plans include habitat typing for evaluation of site potential in each stand. Fragile areas and other specific problem areas are also identified in the compartment plan.

CHAPTER 5

RESIDUAL ADVERSE IMPACTS

This section discusses the adverse impacts which can be expected to remain after a reasonable effort has been exerted to apply all applicable, feasible mitigation measures described in the previous sections. It comprises a compilation of unavoidable impacts not subject to mitigation and residual adverse effects likely to remain despite mitigation efforts.

Because this is an assessment of a program rather than a specific proposed action, this analysis is necessarily to a degree subjective. A judgment factor must be imposed to estimate the effectiveness of mitigating measures based on assumed thoroughness of execution and probability that favorable procedures will be used and enforced; and furthermore, that the contractor or private operator will be cooperative.

CLIMATE AND AIR QUALITY

There is the potential for cutting practices to have some unavoidable adverse impacts on local climates. For example, it may be necessary to clearcut a specific insect-infected timber stand on a severe site, and to burn the slash to forestall an epidemic. The resulting exposure may create micro-climatic conditions which make regeneration of the site very difficult. Deviation of the general climate from its normal pattern for a year or two after cutting may cause micro-climatic changes which inhibit regeneration and favor the invasion of the site by undesirable plants.

Short term air pollution by engine emissions and dust during logging operations is usually unavoidable but relatively insignificant.

The unavoidable adverse impacts of road construction and log hauling on local climate are relatively minor. Air quality will be temporarily degraded by engine emissions and dust in the vicinity or road construction operations and along logging roads. Micro-climates will be permanently modified in limited areas on road rights-of-way.

Despite improved smoke management technology, there will continue to be occasions when smoke from burning forest fuels will find its way into the lower atmosphere over population centers. These occurrences will be significant only as a temporary nuisance. There is the potential for misapplication of prescribed burning techniques due to human error in weather forecasting or judgment in conducting burning operations.

SOILS AND GEOLOGY

Some soil erosion and/or soil compaction will occur during cutting, yarding, and road building operations. Erosion will occur on sidecast material and particularly on steep terrain while compaction will prevail on the more level sites involved in yarding, loading, and roads. Landslides and gravitational erosion cannot be completely eliminated and will periodically occur along roads as a result of freeze-thaw actions and from the water saturation of slopes during the rain and winter seasons. Severe rainstorms and spring runoff will occasionally cause blockages of drainage facilities and road washouts resulting in soil movement and loss. Accidental spills of oil, etc., will occur; but their impact can be expected to be minimal.

Development practices, such as scarification, mechanical-trenching and furrowing, area burning, spot burning, and hand clearing will result in some localized erosion due to vegetal destruction. Fire line construction can be expected to result in some erosion.

WATER

Depending upon the harvest method used, the water yield from the disturbed area will temporarily increase. A temporary decrease in water quality may occur, with the normal duration of these changes lasting two years. Removal of vegetation will cause minor changes in seasonal distributions of runoff and in the magnitude of spring runoff flows. On sites with unstable soils, higher peak-flow could conceivably initiate a cycle of stream erosion and slope failures with a decrease in water quality.

Watercourses near or adjacent to road construction projects can be expected to carry additional suspended sediment during construction. This sediment may be derived from excavation, embankment, and bridge construction, culvert installation, and surface runoff from road and fill surfaces. Subsequently, culverts, slopes, and surfaces may fail from water saturation, heavy loading, or blockage by debris following heavy rains or spring runoff. Runoff will bypass regular channels and carry sediment to the streams.

Heavy rains may cause an increase in slope instability with a large debris avalanche or soil slump resulting. In such events, buffer strips may not prevent masses of debris and soil from reaching a stream.

Logging activity will cause some unavoidable soil disturbance which can result in increased runoff during periods of heavy precipitation. Reduction of crown cover will increase snow depths on timbered areas which can increase total snow melt runoff.

VEGETATION

Short term adverse impacts like the removal of existing vegetation in the form of brush will frequently be accepted as a cost of avoiding adverse long term impacts such as excessive reforestation time lag. An example of this process occurs in the practice of mechanical slash piling and burning. The prime objective of this procedure is to prepare the site for natural or artificial regeneration by removing enough of the existing vegetation to allow the desired trees to become established.

It is possible that desired results from silvicultural treatments may not occur as scheduled or may occasionally fail. For example, seed trees may not produce enough seed to stock a cutting area or a serious wind storm may break off or wind throw seed trees. Sites so damaged are not lost from forest productivity, but if a forest stand is to be established on such sites within a five year time frame, the stand may have to be established artificially.

As the "state of the art" for identifying rare and endangered flora develops, some adverse impact could conceivably occur. However, if mitigating measures are followed as mentioned in Chapter 4, Mitigating or Enhancing Measures, no impact is likely to occur here.

ANIMALS

The most significant adverse impact to wildlife resulting from a timber harvest program is the result of road building and resultant ease of human access to the wildlife habitat. Increased human activity, traffic, and noise would be most detrimental to grizzly bear, wolf, elk, and deer. While much of this disturbance will be mitigated, adverse impacts cannot be completely avoided.

Vegetative changes resulting from timber management activities may permanently affect habitat and animal population use and distribution. Impacts beneficial to one species may be detrimental to another. Existing animal patterns of use will be altered by both increased disturbance and vegetative changes.

PREHISTORIC AND HISTORIC FEATURES

Damage to unknown sites and subsurface sites not discovered during project surveillance would be almost certain to occur. In cases where salvage mitigation is required, the impact would not be fully mitigated. Salvage of cultural resources is an unavoidable adverse impact. Once excavated, a site is effectively destroyed and removed from future research considerations which may utilize new techniques. Salvage is rarely as effective as non-salvage research programs, partially because of time limitation, funding, and personnel competence. Emergency salvage, required by unexpected discoveries during project initiations, would be even less effective.

RECREATION

The timber management program will continue to cause some impairment of landscape character values, even when all feasible mitigating measures are carefully applied. Atmospheric smoke from prescribed burning and dust from road construction and logging will be visible at times for a period of short duration. Clearcuts and seed tree cuts will cause some detraction from the natural appearance of the forest until regeneration is again established. Road cuts and fills and soil disturbances will have the most lasting negative effect on aesthetics.

SOCIO-ECONOMIC CONDITIONS

The primary unavoidable impact involves workers in timber related jobs. Economic impact of the program on small communities can be significant. Despite safety programs and safety consciousness of employees, accidents that cause injury and occasionally deaths can happen. Accidents involving the motoring public and log trucks and other logging equipment may occur as long as simultaneous use is made of the road.

There should be no unavoidable impacts on nearby residential or commercial enterprises. An exception may occur in cases where unsuitable and incompatible land uses, such as an unplanned subdivision, encroach on a management area and, upon considered evaluation, it is determined that restriction of timber management activities in deference to the encroachment would not be in the best interests of the public.

LAND USE

There will always be some cases where timber management activities will impact adjoining lands, particularly where forested private land is used for residences or some recreational activities. The land use planning process resolves or compromises conflicts; it cannot always solve them.

In compromising conflicts between land uses and recognizing the diversity of individual opinion on what is good forest management, it is unlikely that everyone will get what they want and expect all the time on lands involved in the timber management plan.

Cases may arise where the cumulative impact of a private landowner's operation and BLM operations will not be acceptable. If the landowner initiates the first action, it would be up to the BLM to evaluate it and revise, deter, or abandon its proposal. If the situation were reversed, the BLM would have little or no control.

ECOLOGY

Most practices will alter the appearance of the ecosystem and temporarily disrupt the balanced relationships between its components, particularly those practices that involve soil movement and vegetal destruction. The nutrient cycle, hydrologic cycle, and energy flows will be interrupted or altered until the impacted areas are revegetated and the ground stabilized. Fragile ecosystems, where productivity is low and the natural balance delicate, will be most severely impacted and slowest to recover. In the areas occupied by mainline roads, existing ecosystem relationships will never be restored during the life of the facility.

Almost any action of man that affects the biotic community and/or the physical environment will impact the ecosystem to some degree regardless of the mitigative measures that are brought to bear. However, with the proper application of timber management practices, the impact should be minimal in terms of the basic processes of the ecosystem and of relatively short duration, normally two to five years.

A beneficial effect of the proposed action is that it will aid in controlling the biomass buildup caused by a natural imbalance between production and decomposition of ecosystems in the region. The only other method of correcting this imbalance is with fire.

CHAPTER 6

SHORT TERM USE VS. LONG TERM PRODUCTIVITY

The timber management program is, of course, not a short term use but a continuous use which involves different actions being applied to different parts of the forest over time. Most of the individual practices carried out on a particular area involve a short term use.

The length of the proposed action, which is considered the short term, is limited to a 10-year period from 1974 to 1984. At that time, a new inventory, new multiple-use considerations, re-evaluation of management practices, and current public involvement will produce a revised allowable cut for the next 10-year period. This chapter largely deals with evaluating the effect of a 10-year proposal on the forest productivity beyond 1984. In computing the level of raw materials available for harvest from the SYU, harvest volume and all forest management practices were projected for a 400-year period. This is done to assure that lands could be productive at the proposed level for 400 years. The long term is considered to be that time beyond the initial 10-year proposed action time period. Inventory data indicates that through most of the 400-year period, growth will exceed the cut.

CLIMATE AND AIR QUALITY

The practices associated with the proposed action do not significantly affect the climate or air with regard to short term use or long term productivity of the forest.

SOILS AND GEOLOGY

While some development practices may have a short term detrimental impact on localized areas, most practices will not affect long term productivity. The area occupied by permanent roads will not be productive during the life of the facility.

Reduced productivity of areas occupied by temporary roads can be expected.

WATER

Since snowmelt forms a significant portion of the seasonal runoff, the increased snowpack that occurs following cutting, particularly clearcutting, may be a benefit by increasing water yield on a short term basis. Adverse impacts would include a possible decrease in water quality and increased peak flows. Where slopes and stream channels are stable, a small increase will have no adverse effects and suspended sediment concentrations will remain relatively stable. Since the management plan calls for continuous scattered harvests throughout the SYU, this is a long term benefit. Periodic erosion along roadways resulting from seasonal rains and storms will have a minimal impact on the productivity of the aquatic ecosystem.

VEGETATION

The short term use of land for timber harvest will generally have little, if any, adverse impact on long term vegetative productivity provided the necessary mitigative measures are carried out. Vegetation is a renewable resource, capable of re-establishment after timber harvest

and forest development actions. Through natural revegetation and man controlled forest development actions, the forest resource can be maintained. Management will increase vigor of forest vegetation. Periods of declining growth and stagnation of trees will be reduced. Practices proposed will not have a significant effect on diversity of vegetation.

ANIMALS

Plant succession following logging through time will modify buth the quality and quantity of wildlife habitat. The vegetation available after logging, especially herbaceous and browse species, will benefit larger mammals such as elk, moose, and mule deer. The long term benefits following logging would outweigh the short term effects (2-5 years to reach successional stages desirable for elk, deer, and moose). The effects of logging would provide long term benefits not possible at this time with the control of wildfires. Logging would provide successional stages originally possible through natural fires and desirable for wildlife species associated with these stages of plant succession.

PREHISTORIC AND HISTORIC FEATURES

The potential impacts on prehistoric and historic features will be analyzed in the site specific environmental assessments.

RECREATION

Most forest management practices will cause some alteration to the visual, sound, or odor characteristics of the landscape. All major change agents will be analyzed in the site specific environmental assessments.

SOCIO-ECONOMIC CONDITIONS

The timber program will have a slightly favorable short and long term effect on the economies of the SYU. It will lend some additional stability to the local lumber and logging industry. It will have some negative short term influence on a site specific basis for some recreational users. Grazing use may be temporarily restricted on areas where livestock conflict with seedling establishment.

LAND USE

Some timbered areas will lose their undeveloped atmosphere. With the cutting and road building activities, these areas will not be suitable for some uses. Long periods of time (20-100 years) would be necessary to reverse the process. Occasionally, a management action would cause a loss of productivity on some sites due to a lack of complete knowledge about the site.

Due in part to other resource values, roughly half of the commercial forest land in the unit is not in the acreage base used to compute the allowable cut. While this may change some in the future, it does have a negative impact on the productivity of the forest lands where cutting will not occur.

ECOLOGY

The productivity of an impacted area will be reduced where permanent structures such as roads are constructed, bare rock is exposed, or unstable soil conditions exist. Long term productivity of timber stands will be enhanced through removal of surplus biomass and increased cycling of nutrients.

CHAPTER 7

IRRETRIEVABLE RESOURCE COMMITMENTS

This section is focused on the long term impacts of the timber management program from the perspective of irrevocable uses of resources; for example, massive erosion, destruction of human interest values, elimination of endangered species and their habitat, and irreversible changes in land use. The consideration of these consequences is based upon residual impacts after mitigating measures have been employed.

CLIMATE AND AIR QUALITY

No irretrievable resource commitments are identified for the environmental component of climate and air quality.

SOILS AND GEOLOGY

Erosion induced by removal of the vegetative cover and the construction of roads produces an indeterminable amount of localized mass wasting which cannot be reversed or retrieved. When the vegetal cover is removed from an area where steep slopes occur and moisture is abundant, erosion will sustain itself. Where rock types and structure are conducive to weathering, the erosional rates will increase. Erosion tends toward an equilibrium over geologic time. However, in terms of the human life span, erosion caused by man's activities results in an imbalance.

Approximately three percent of the land area will be committed to mainline roads, which constitute a relatively irretrievable use; however,

the trend towards logging systems which requires less roads would reduce these percentages in the future. This percentage does not include those areas in landslides which may result from logging. The soil, rock, gravel, and other materials used to construct the roads and structures represent a form of depletion and a permanent commitment of resources. In a theoretical sense, however, the decision could be made for roads to be abandoned and the right-of-way returned to productive acreage.

WATER

Watershed values of a drainage are irretrievably committed, to a degree, where bare rock has been exposed or exposures of bare rock have been enlarged by massive soil movements. Landslides can also destroy a natural stream channel, resulting in its relocation and the accompanying permanent loss of soil and other materials. In this unit, however, these commitments are unlikely.

VEGETATION

No irretrievable impacts of timber management practices are anticipated on vegetation. Even where drastic misapplications may occur and result in extensive delays in tree regeneration, natural plant succession and technical progress can be expected to restore the site to a forest condition. Only where landslides expose rock surfaces can the forest condition be considered irretrievably lost. Some modifications or substitutions in species composition are likely to occur. An examination on the "compartment" level of the possible occurrence of rare and endangered or threatened plant species will become necessary if species are identified which qualify in these descriptions. If so, appropriate mitigating measures will be taken.

ANIMALS

No irretrievable effect on animal populations is anticipated as a result of the proposed action.

PREHISTORIC AND HISTORIC FEATURES

Inadvertent damage or destruction of archaeological sites would probably be an irretrievable loss. If sites were not completely destroyed, enough salvage might be possible to retain their human interest value.

Conceivably, historic sites that are the works of man could be restored should they be destroyed. However, their values would be diminished or lost.

RECREATION

Roads, and to some extent the cutting areas, will create a permanent change in landscape character. To the extent that the resulting landscape offends a viewer, the impact is irreversible.

SOCIO-ECONOMIC CONDITIONS

Accidents among timber related employees that cause permanent injury or death are, of course, irreversible and irretrievable. This also applies to members of the public injured or killed in accidents involving log trucks or other equipment.

Timber management does not commit recreational values to irrevocable loss or degradation. However, at the time a given practice is carried out, some recreational values, e.g., solitude, may be impacted; thus representing an irretrievable loss to the individual affected.

LAND USE

There will be no irreversible and irretrievable loss of lands for residential, commerical, and industrial uses. Any loss of soil caused by timber management activities can be considered irretrievable in terms of potential agricultural development of an area. Some areas of forest range may be committed to timber production; however, this classification does not constitute an irreversible action. However, any amount of livestock production foregone, where grazing capacity is affected by timber management objectives, represents an irretrievable loss.

ECOLOGY

Certain components of the biotic community and physical environment, such as endangered species, would represent irretrievable losses, if annihilated as a result of some catastrophic event. However, the basic ecological processes would probably recover and continue. Occasional situations occur in which the natural balance has obviously been damaged beyond repair. One example is the exposure of bedrock by mass soil movement, where restoration of life-sustaining abiotic environment can be accomplished only by natural processes operating over a period of geologic time. The incidence of such occurrences and amount of land so affected would be minimal. The greatest risk of irretrievable impacts on the ecosystem resulting from soil erosion following the loss of vegetal cover exists in fragile areas. Much is unknown regarding ecological interrelationships; therefore, there may be irreversible impacts that are not presently recognized.

CHAPTER 8

ALTERNATIVES TO THE PROPOSED ACTION

Three alternatives have been considered to the proposed action on the SYU. These are:

ALTERNATIVE A. A PROGRAM OF NO TIMBER MANAGEMENT

ALTERNATIVE B. MAINTAINING A TIMBER MANAGEMENT PROGRAM BASED ENTIRELY ON NATURAL PRODUCTION

ALTERNATIVE C. UTILIZATION OF EXOTIC SKIDDING EQUIPMENT

ALTERNATIVE A. A PROGRAM OF NO TIMBER MANAGEMENT

Description of Alternative

This alternative would require the cessation of all timber harvesting on public lands in the SYU. It is assumed that some of the protection practices associated with timber management in this alternative, such as fire suppression, forest pest control, reforestation of denuded areas and trespass control actions, will continue to be carried out to some extent to protect and enhance non-timber values and uses.

It is important to point out that the Bureau administered lands are intermingled with private or other publicly managed forests, often as small isolated blocks or in a checkerboard pattern of squares 640 acres in size or smaller. Consequently, even without a Bureau timber management program, the timber management practices carried out by adjacent private landowners or managers will continue to have an impact on the environment of the Bureau administered forests insofar as road building and log hauling across the public lands and other activities are concerned. However, these impacts are beyond the scope of this analysis.

Environmental Impacts

CLIMATE AND AIR QUALITY

The cessation of the prescribed burning of approximately 200 acres of logging debris each year will eliminate the temporary nuisance of the resulting smoke. In general, however, there will be little or no change in air quality under the no-program alternative.

SOILS AND GEOLOGY

Soils will be stable as a result of little surface disturbance, and erosion will be limited to localized areas where wildfires and natural slides or slumps occur. Soil compaction will be localized to relatively small areas subjected to intensive human use. Any road construction for the purpose of providing public access or means for transporting private timber will represent the major impact on soil stability.

WATER

The closed forest canopies will reduce water yields, particularly from snow zones and watersheds were spring rainfall constitutes a significant portion of total annual precipitation. Flood and other runoff peak levels will generally be reduced. Water quality would be the highest naturally obtainable; however, the eutrophication of inland waters would continue as a result of natural soil erosion. Water temperatures would also be generally the lowest obtainable under natural conditions.

VEGETATION

This alternative will result in the preservation or creation, over time, of forests comprised primarily of overmature stands of trees. Current timber management objectives call for the harvest of crop trees when reaching]20 years of age. No timber cutting would result in many trees reaching ages of 300 to 500 years and older, at which time natural mortality would occur and regeneration would begin. The pathological, or natural rotation, would result in a significant reduction in the growth of wood. For wxample, an acre of trees harvested over five successive rotations of 100 years each will grow two to three times as much wood as found on an acre of 500-year old trees. There will be a long term trend towards climax types of vegetation which represents the mature or final stage in succession. This evolution will eventually produce, on some sites, vegetative types far different than now exist. Generally, climax vegetation is more tolerant and stable, and their canopies will eliminate considerable vegetation from the forest floor due to competition for sunlight, moisture, and nutrients.

Windfalls, individual snags, and groups of dead trees would be common. Their deterioration would result in a large amount of debris on the forest floor. This, together with general stand decadence, would increase the susceptibility of the forest to fires, insect infestations, and disease. Control of these destructive agenst would be hampered in unroaded areas.

ANIMALS

The elimination of thinning and harvesting practices may have an adverse impact on those wildlife species which require low vegetation as a source of food or habitat. Consequently, reduction in the populations

of such animals as deer, elk, rabbits, and ruffed grouse could be expected. On the other hand, old growth forests will support greater populations of small birds, squirrels, insects, and other organisms that inhabit the high foliage canopy or the soil. The existence of snags and deadtop trees will improve the habitat for such wildlife as eagles, hawks, owls, and woodpeckers by serving as nesting and perching sites and as food sources. Furthermore, the undisturbed forest will provide more suitable habitat for species which are particularly sensitive to human activities. Generally, however, the more uniform canopy cover of the undisturbed forest, having less "edge" between different vegetative types of canopies, would tend to produce a lesser variety of both flora and fauna than a forest under timber management. Large accumulations of dead timber on the forest floor will make some areas inaccessible to large animals.

In general, high water quality will be maintained with resulting benefits to aquatic wildlife. Due to reduced surface runoff, stream sedimentation will be generally limited to natural eutrophication, thereby helping to stabilize the habitat of fish and aquatic organisms. However, stream debris, in the form of windthrown timber, will increase and in some instances will result in inaccessible barriers to fish movement.

PRESHITORIC AND HISTORIC FEATURES

The possible destruction of archaeological and historical sites and values caused by timber management operations will be eliminated. Unknown archaeological and historical sites which are buried and may have been uncovered under the proposed action will not be discovered.

RECREATION

One impact of a no-timber program on recreation will be the cessation of clearcutting on approximately 140 acres annually. Areas recently harvested could be reforested within 5 years, and the succeeding growth of the trees in the next 15 to 20 years would erase most of the undesirable characteristics associated with existing clearcut areas. The natural succession of plant and tree species will take place over time, and the preponderance of over mature or old growth stands will be generally pleasing to most forest viewers. Reduced road construction along with the elimination of the smell, sound, dust, and smoke of other operations will contribute further to the "natural" appearance or mood conveyed to forest visitors.

The increased presence of lightning-prone flammable dead trees or snags resulting from natural mortality and insect and disease infestation in conjunction with the reduced access resulting from less road construction, will increase the risk of naturally caused fires and man's ability to control them, respectively. This will be offset in part by the elimination of fires stemming from timber management practices. Nonetheless, the increased incidence of wildfires will significantly impact aesthetic as well as other values. The increase in unharvested dead trees due to natural mortality and insect and disease infestations will also affect aesthetic values.

SOCIO-ECONOMIC CONDITIONS

The local socio-economic consequences of this alternative would affect smaller mills and logging operators in outlying communities in the SYU. Approximately 44 primary timber-related jobs and 80 secondary jobs (retail trade, service, etc.) would be lost annually if it were possible to implement the total program. While some opportunities for

geographic relocation and other sources of employment may be available, it can be expected that most unemployment with its attendant social and economic hardships to individuals and smaller communities would result. This will be slightly offset by the accompanying reduction in industrial accidents and their corresponding social and economic costs.

The revenue foregone to the U.S. Treasury and applicable local governments from the sale of timber will total about $156,000 annually.

The socio-economic impacts of a no-timber management program could, conceivably, be offset in part by any gains in non-timber related forest uses and values, such as increased recreational use. These could stimulate or increase corresponding forms of economic activity; however, the net effect could be expected to be a decrease in employment and gross national product.

The relatively high quality of undisturbed streams will appeal to fishermen and swimmers so long as accessibility and fish habitat are unimpeded. Conversely, there will be fewer recreational opportunities for hunters, since the population of predominant game species such as deer and elk may be decreased due to reduced food supplies. The reduction in the diversity of animals due to the elimination of the "edge effect" created by cutting practices will adversely affect some naturalists and birdwatchers. On the other hand, opportunities will be available to observe relatively unique species or habitats associated with unharvested forests.

Reduced road construction will prevent vehicular access to many areas, thereby minimizing or precluding some recreational uses and the development of facilities such as campgrounds and picnic areas. In other cases, reduced road construction will encourage hunting use in areas not disturbed by logging or road construction activities.

Many of the recreation related environmental impacts are offsetting as far as the various public user groups are concerned. However, this alternative will probably be most favorable to those segments of the public who enjoy the non-commodity values or non-intensive uses of the forest such as hikers, naturalists, and wilderness seekers.

LAND USE

The impact of this alternative as it relates to the local requirements for the multiple use management of the public lands would require exploration and, if necessary, the applicable laws changed. Conflicts with adjoining land uses which may occur under the proposed action would be eliminated. However, the no-action alternative may also create conflicts with adjoining land uses.

ECOLOGY

The basic ecological processes involving the nutrient and hydrologic cycles and energy flows will be relatively undisturbed. However, natural forces and human activities will continue to influence various components of the ecosystem. The characteristics of its basic living component, vegetation, will change over time following a cyclic successional pattern. Along with it, the populations and species makeup of forest life will change as the vegetation changes in terms of species and their stages of maturity.

Mitigating or Enhancing Measures

CLIMATE AND AIR QUALITY

No mitigation is required with Alternative A.

SOILS AND GEOLOGY

No mitigation is required with Alternative A.

WATER

No mitigation is required with Alternative A.

VEGETATION

Seral plant communities could be maintained in a portion of the forest stands through the use of fire. Natural fires and prescribed burns can be utilized to manipulate plant communities away from climax. Maintenance or creation of the "edge effect" and understory vegetation required by certain wildlife animals would result. Heavy accumulations of fuels on the forest floor, which pose a severe fire hazard and create a barrier to large animal movements, would be reduced.

Mitigation of dangers to Rare and Endangered and or Threatened plant species if identified would not be required with Alternative A.

ANIMALS

No mitigation is required with Alternative A.

PREHISTORIC AND HISTORIC FEATURES

No mitigation is required with Alternative A.

RECREATION

No mitigation is required with Alternative A.

SOCIO-ECONOMIC CONDITIONS

Mitigation of the loss of revenue and employment in the forest products and secondary industries is not possible.

Future reduction of primary game animals such as elk and deer due to loss of desirable seral vegetative communities can be partially mitigated through the use of fire as described under vegetation mitigation.

LAND USE

No mitigation is required with Alternative A.

ECOLOGY

No mitigation is required with Alternative A.

Residual Adverse Impacts

Only the environmental components that are expected to receive residual adverse impacts as a result of Alternative A are addressed below.

VEGETATION

The use of fire to manipulate vegetation is a valuable tool. However, fire is not a substitute for timber management practices in most cases. The majority of forest communities will continue their succession toward climax plant communities during the next several decades and centuries. Reductions of desirable understory vegetation for large animals will result in lower carrying capacity. Thus, populations of large animals will be reduced.

Future mortality of mature, insect infested and diseased timber will create large volumes of forest fuels which are conducive to the ignition and spread of intense wildfires and also create barrier to large animal movement.

SOCIO-ECONOMIC CONDITIONS

The loss of revenue and employment resulting from not managing the forest lands presently designated for timber management will be permanent. Approximately 124 primary and secondary jobs and $156,000 in revenue from stumpage will be lost annually. While the jobs and revenues contribute only a small amount on a statewide basis, they are very important to some individuals and small communities.

Reduction of big game populations resulting from predicted vegetative trends and conditions will have a probable adverse effect on revenue derived from hunting.

Short Term Uses Vs. Long Term Productivity

The no-timber program would generally result in reduced land productivity. Climate, air quality, soils, recreation, and water quality will improve under this alternative for an indefinite period of time.

Long term production of what is presently desirable vegetative products will decline. Animal use and human activities dependent on these products will be adversely affected.

Irreversible Actions and Irretrievable Resource Commitments

The only irretrievable resource commitment under the no-action alternative is the loss of land productivity through non-use of timber resources. The growth lost through mortality would be irretrievable. However, should a no-timber management land use decision be reversed in the future, accumulated growth would be retrievable.

ALTERNATIVE B. MAINTAINING A TIMBER MANAGEMENT PROGRAM BASED ENTIRELY ON NATURAL PRODUCTION

In this alternative, timber growth, and consequently timber yield, is regulated by the forest's natural ability to reproduce itself following harvest without any cultural or artificial treatment by man. This alternative would have a decadal sustainable harvest level of 43 MMbf in the Dillon SYU. Intensive management practices account for 12.5 percent of the proposed action sustainable volume. The impacts of this alternative would be essentially the same as described in Chapter 3, Environmental Impacts. Data in Chapters 4 through 7 would also apply to this alternative.

ALTERNATIVE C. UTILIZATION OF EXOTIC SKIDDING EQUIPMENT

This alternative consists of utilizing sophisticated log skidding systems which are foreign to the SYU locality. Helicopters, balloons,

and skyline cable systems are used in the West Coast forest where timber values and volumes are high. Volumes and values of timber located on the SYU will not currently justify the use of these costly skidding systems. Environmental impacts associated with these skidding systems would be essentially the same as those described in Chapter 3. The major advantage they provide over conventional skidding methods described in the proposed action is less total soil disturbance (fewer roads and skid trails) and resulting adverse effects caused by the disturbance.

CHAPTER 9

CONSULTATION AND COORDINATION

The interdisciplinary team responsible for producing this document has consulted with a variety of sources in obtaining data and opinions. The development of a timber sale plan involves a rather continuous process of public consultation and coordination of technical input. The major points of public interaction are:

1. The District Land Use Plans, which consist of the Unit Resource Analysis (URA) and Management Framework Plans (MFP), set the guidelines under which the timber sale plan is developed and carried out. These plans undergo a systematic exposure for gaining public input during their development and are updated as necessary. The plans covering this unit meet this standard.

2. An Annual Timber Sale Plan is developed for the unit and sent to parties with an interest in our program including individuals, public interest groups, conservation-oriented organizations, other governmental units, as well as representation of the timber industry.

3. Detailed information on tracts listed in the annual sale plan is available to anyone upon request at the BLM District Office.

4. Copies of all the individual district annual timber sale plans are sent to the BLM State Office where they undergo review and consolidation.

5. Review by the public on the Draft was accomplished through newspaper, television, radio, and two open house sessions.

Public comment on the Draft is included in this chapter. A copy of the letter on revisions sent out to all those on the Draft EAR mailing list is attached.

IN REPLY REFER TO

5110

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
District Office
Box 308
Butte, Montana 59701

AUG 31 1977

Gentlemen:

This letter is to inform you of significant changes which will be found in the final Environmental Assessment Record for the Timber Management Plan on the Dillon Sustained Yield Unit. These changes followed public review of the Draft and subsequent response to public input.

A considerable amount of objection was received pertaining to the magnitude of the reduction in base acreage available for timber harvest. A decision had been made in 1973 to go with the most restrictive harvest proposal which reduced the productive forest (capable of producing 20 cubic ft./acre/yr.) land base from a total of 171,800 acres to 42,300 acres or a percentage reduction of 75%. The timber production capacity of this remaining acreage was further reduced by 23% due to multiple use partial restrictions on yield. We were asked to take a careful look at these restrictions.

The following changes were made after this review.

	Old Restriction	100%	Partial	New Restriction	100%	Partial
1)	Roadside Corridor	13293	--	Roadside Corridor	--	--
2)	Wildlife Habitat	20367	15609	Wildlife Habitat	2905	26242
3)	Streamside Protection	3909	--	Streamside Protection	2939	1952
4)	Watershed	49003	8763	Watershed	2925	20738
5)	Topographic	3856	--	Topographic	36158	--
6)	Scenic Corridors	13752	3908	Scenic Withdrawal	--	3938

AMERICAN REVOLUTION BICENTENNIAL 1776-1976

7)	Recreation	6833	978	Recreation	--	978
8)	Roadless Study	--	--	Roadless Study	27796	--
9)	Custodial	18483	978	Custodial	--	--
TOTALS		129,496	30,236		72723	53848

An explanation of the above changes is as follows.

1) A review of plots which had been restricted as roadside corridor raised some serious doubts as to validity of the category. Investigation showed a coding error caused by placement of a zero had thrown these plots into a 100% restriction when in fact they should have been without restriction.

2) Our interdisciplinary review procedures required prior to on the ground harvest activity and new knowledge available regarding timber harvest - wildlife relationships showed this restriction to be unnecessarily severe. It was modified accordingly. A considerable amount of the acreage previously restricted 100% for 'Wildlife Habitat' is now partially restricted or reflected as 100% restricted under other categories.

3) No significant overall change in Streamside Protection.

4-5) These are listed together due to their close relationship in definition on the ground. All acreage of over 55% slope was automatically 100% removed from the base as a topographic restriction. Much of this acreage was previously removed under 'Watershed'. Additional acreage previously removed in the above categories is now reflected under 'Roadless Study'.

6) Existing interpretation reclassified this acreage either into another restriction or restored it to the base. Continuous canopy timber management does not often require a 100% restriction in timber production capability.

7) See 'Roadless Study' below.

8) In order to better reflect the impact of these areas on land use for timber production, we decided to classify all plots in known study areas as 100% withdrawn for that reason. Much of this acreage had previously been wtihdrawn under some other category.

9) These plots are on the low end of the productive forest land scale. They were previously shown under 100% restriction with allowance for some salvage. They have been restored to the productive base but no doubt have little contribution to total havestable volumes. They will continue to be managed for wood production on a low key basis.

June 10, 1977
H&R Lumber Products, Inc.
971 East Center
Dillon, Montana

Bureau of Land Management
District Office
P.O. Box 308
Butte, Montana 59701

Gentlemen:

These comments are in reference to you're "Environmental Assesment Draft" Dillon Sustained Yield Unit, Timber Management Plan, May 1977.

The above document has been tremendously dissapointing from a professional standpoint, as a tax payer as well as from a part owner of a business thas is dependent on a viable timber base. My feelings will be discussed in more detail as follows.

The entire format and editing is poor. Repitition and contradiction appear continually. The authors personal philosophy of any utilization or developement will be damaging is continually present yet the volume of cut proposed is so small compared to what could be done or should be done considering stand conditions that even you're worse fears should not have much impact.

Why was the impact of lack of utilization and management of stands not addressed better. With fire control there are definite trend changes in the ecology that could well be permanent; wildlife changes, impact to adjacent landowners attempting to manage and utilize their renewable resources - will the BLM be accountable for this management direction?.

It is obvious that much of the material has come from other reports out of the area. Is this "Cookbook" approach acceptable to the BLM standards? The logging equipment segment obviously was put together
4. by some one not familiar with all systems. Perhaps this could be updated by either having some people spend some time on the ground or having experienced people incorporate their knowledge. For example Idahoe Skidding jammers work off the principal that the front end of the log is lifted, a basic high-lead

two-drum system. Many shovels now have the line capacity to skid ~~both~~ out 400 to 500 feet and both jammers and shovels have been used for partial cuts. Tremendous discussion of systems not applicable to area; Why?

The continued reference to cat skidding damage was amazing. Winter skidding on soft areas with an integrated arch-fairlead will have no more effect than horse logging without the manure!

Rubber tired articulated skidders are being used on grounds up to 60% in slope with good results. Longer skidding distances are being accomplished thus lowering the impact of roads.

Continual fear that compaction will do damage due to the skidding, scarification, etc. Where is the data substantiating this. In this country where we develope frost every season compaction last usually less than one season, this includes roads. Perhaps one should check some of the local county roads in the spring to verify this.

Very little address is made to existing stand condition or composition yet very severe land allocation and management guidelines have been made. Why was this done without this information.

Why was road control-management not discussed in more detail? This could resolve most wildlife conflics as well as minimize construction standards by not building all-weather roads.

The immediate present problems of the timber base for harvest in the Dillon SYU is further compounded by this report. Due to lack of available Federal sales there has been a definite shift to private timber in the Dillon SYU. This available timber base is limited since the majority of timber is under Federal management(?) and is currently being very dramatically removed from the harvest base that is available. You state that minimum economic impact due to this plan. What about the potential? The local area has had high unemployment and the local timber industry directly employees 135 plus people with a direct impact annually to the area of 8½ million dollars. Nationally can we afford not utilizing this renewable resource? In most cases harvesting can be complimentary to

most wildlife as well as definetely complimentary to watershed management, to grazing, to dispersed recreation. The access systems would allow better management of all resources except Wilderness or Primitive. The dispersed ownership pattern of the BLM lands one wonders about the concern of visual impact corridors. Perhaps over emphasized.

As a third generation Montanian attempting to raise my family; as a professional Forestor; I am deeply concerned about the people and the direction the stewardship of our public lands have taken. How much non-developement can we stand as a Nation? We are told to conserve and utilize and then told we should allocate large tracts of land to non-developement that results in loss of the timber value, grass, second-rate watershed management, as well as hampering exploration and developement of our mineral potential;

Would like to encourage further assesment of you're timber value and resources. We need as progressive ~~a~~ timber program as possible for the local timber industry is definetely not in good shape from a timber supply standpoint. The Forest Service has dramaticilly decreased its Sales Program, the private timber base is fixed. You're timber program could well be key to the survival of this utilization management option. Thank you for the opportunity to comment.

Sincerly;

John E Burns
Manager

John Bruns
H&R Lumber Products, Inc.
971 East Center
Dillon, Montana 59725

1-c The nature of the required format for Environmental Assessment Records and Statements is repetitive and contradictory. Following the Description of the Environment in Chapter 2, a description of Environmental Impacts is begun in Chapter 3. At this point it would appear that the authors were against utilization and development. The entire document including especially Chapter 4 covering Mitigating and Enhancing Measures must be reviewed with a picture of the entire process in mind.

Review the changes in restrictions made following re-evaluation. The forest management plan must consider all uses.

2-c The impact of no timber harvest program is covered in Chapter 8 - Alternative A.

3-c Use of intensive analysis on a case by case basis is specified in the plan as necessary for future actions. This will be accomplished through Compartment Development Plans. The Environmental Assessment Record is meant to be general.

4-c The description of logging methods is general. All applicable practical methods are covered. No method is the answer in all instances. Description of the Idaho jammer was modified to include its ability to lift one end of the log. While this system has definite applicability to some areas covered by the EAR it is not a "high-lead" system. Chapter 1-14 already states a jammer may be used for distances up to 500 feet. We have left options open for consideration of all types of logging methods.

Your point on winter skidding is well taken and included in Soil and Vegetation portions of Chapter 4.

5-c The "frost" factor in reducing compaction has been mentioned in Chapter 4-3. It is not, however, a cure-all which corrects all compaction problems.

6-c A % stocking table by crown density and size classes has been added to Chapter 2-17. This kind of information is available on a SYU wide basis and can be tied to roughly to legal descriptions. This kind of information was used in the volume-area-cutting practice portions of our inventory. It was considered of lesser importance to land allocation decisions. Stand condition is a foremost concern in the management of lands allocated to timber production.

7-c Road control management is mentioned in the document, Ref. 4-16, and considered an important management tool. We have re-evaluated the land

use restrictions determined in 1973 using todays information and made some changes in use allocations. The timber supply problems in the Dillon area are more than BLM wide. Existing manpower and funding are not now adequate to produce even the original 17.3 MM/decade cut, and until we get a change there problems will continue to exist.

8-c Potential economic impact is expanded in Chapter 3 - Socio Economic Conditions.

9-c Values of timber harvest as a management tool to enhance other uses and as a replacement for the attributes of wild fire are well known. This fact has been taken into account more thoroughly in our more recent evaluation.

Michael Lyngholm, Woods Mgr.
Stoltze Land and Lumber Co.
Dillon, Montana 59725

Bureau of Land Manageme[illegible]
[illegible]rict Office
[illegible] 309
[illegible]tte, Montana 59701

Gentlemen:

I am writing to voice my concerns with the draft EAR fo[illegible] the Timber Management Plan, Dillon SYU. I did not like the draft EAR. As a professional forester, I am shocked to read a statement which contained so many inaccuracies, and opinions stated as facts. The whole EAR carries the tone that timber harvest is a bad destructive use with very few good points. I personally feel that this statement should be rewritten and edited.

1-d To get down to more specific concerns: on page 1 the record states that 42,328 acres are available for timber management out of 171,827 acres of commercial forest. And then another 23% reduction is placed on this to protect other resource values. I think the BLM has placed all other values above timber. Other values are more important on non-commercial timber land. Shouldn't timber be more important on commercial timber land? At least important enough to rate more than 18% of the commercial timber land which is still subject to other multiple uses on that 18%? Another point on page 1 is the statement that partial cutting will be used 94% of the time. [illegible] has proven that this is not feasible in most LPP stands and many DF stands. This is another downgrading of the timber value for the sake of another value.

2-d The detailed explanation of logging systems seems unneccessary since it is ended by saying that most cannot be used in the area because of the economics of the different systems.

3-d On page 1-21 it is stated that only 50% of a tree is harvested. This may be true however not all of the remaining 50% is left as slash since [illegible] [illegible] as slash. I think [illegible]-40% is a closer value for the gross weight of a tree left as slash.

4-d On page 2-[illegible] it is stated "Forest[illegible] land and elk are inseparable." If this is so, how can the elk herds south of Great Falls, Montana, where I hunt be explained. Also the statement that the Dillon area is known nationally as one of the most important elk hunting areas in the U.S. is only unsupported opinion. I think research would find this statement false. The Dillon area does not provide any more superior habitat for elk than 20 other areas in Montana [illegible].

5-d [illegible] page 2-37 I would like to know who expects to find significant historical places in the SYU especially since none have been found yet. Again timber is placed lower in value than a use which has not [illegible] discovered yet.

On page 3-10: the solar radiation at creek crossings is so negligible that I don't think it deserves mentioning. A crossing is only 20-30 feet wide and is a negligible portion of a stream even if it is crossed several times. This is especially true since the bridge or culvert provides shade for a substantial portion of the R.O.W. clearing. Also the statement "Clearcutting may cause sedimentation," is very misleading in its context. A game trail or a wind-thrown tree can also cause sedimentation. This EAR is supposed to be an
6-d objective scientific presentation of facts. The EAR earlier stated very little clearcutting would be allowed. So the statement on page 3-10 should read something like this,"Various cutting practices may cause varying amounts of sedimentation. However if a type of cutting is properly used, sedimentation is negligible after 2-4 years and is minimized during the logging and first two years thereafter. The bulk of sedimentation comes from road construction with the quantity and quality of the roads determining the amount of sedument eroded until such roads stabilize."

On page 3-13, I agree that fire suppression has a short term favorable effect on water quality, however what happens when the forest fuels build up over 100 years and an uncontrollable fire
7-d results which can strip an entire drainage of protective vegetation. This is a fact which should be mentioned to avoid misleading the public.

On page 3-16, in addition to the uses of roads listed, the following should also be mentioned: recreation and access to recreation,
8-d access for research of the forest land and vegetation, access for grazing management by permittees, and access for hunting.

On page 3-18, it is stated that the size of openings have a negligible influence on elk use. This is in conflict with what I was
9-d taught. Also it is not the increased vehicle access that disturbs elk but the increased hunting pressure during hunting season. This pressure can be regulated by seasonal road closures.

On page 3-28, the first paragraph described the economic benefits of timber harvest. However, the hidden cost of the jobs that could be had at a higher level of timber management should also be mentioned. This is of much more significance to the local communities.
10-d Also, it is true that the Dillon SYU has no impact on the national economy; however, this arguement is being used nationwide on the national timber market is being hard hit by a cummulative cutback everywhere. Therefore this statement that the Dillon SYU has no effect should be explained further in this light.

The section on ecology starting on page 3-32 has a glaring error. The whole discussion talks as though the forests in the SYU would reach a stable climax without mans influence. However, the ecological history in this area is one of constant succession with wind-
11-d storms and wildfires as a regular constant element of the natural history of the area. Research has proven LPP cannot be managed as a climax species by partial cutting. A forest of DF is not the natural vegetation for the Dillon SYU. Controlled burning or logging must be reintroduced into the bulk of the Dillon SYU lands to preserve the natural historic ecology of the area. Otherwise, a

are going to see a gradual but drastic change in the forest types, wildlife habitats, and a probable elimination of some rare endangered plants that cannot survive the change from the historical ecology of the area. On page 4-6 I disagree with the last paragraph. In many cases there is not enough topsoil development especially in the timbered mountains to stockpile and respread over a burial trench for slash. Also hot burns that expose mineral soil with a light layer of ash on top is very conducive to natural reforestation of a cutting area.

I would like to comment on the whole plan but must limit myself to the first half so I can get my comments submitted. I just moved to the area and have not had enough time to study the EAR.

I would like to reemphasize the fact that I feel that the EAR and Timber Managment Plan are too heavily biased toward recreation and non-development.

Too many of the areas of federal land seem to be swinging this direction with the rational that there is increased demand for recreation and the reduced timber harvest will have little national impact. But cumulatively, there is now an over-supply of recreation land for backpackers and a serious shortage of timber supply for housing and building materials.

Timber harvest builds roads and is compatable with many other forest uses including the majority of recreation users. Allocating only 18% of the commercial forest land in the SYU indicates some mistakes in assigning values to the various multiple uses of the land. Especially since this is only 18% of the commercial forest land and this is only one-third of the total BLM lands in the Dillon SYU.

Yours truly,

Michael Lyngholm

Michael Lyngholm

Michael Lyngholm, Woods Manager
Stoltze Land and Lumber Co.
Dillon, Montana 59725

1-d After re-evaluation of restrictions the total acreage available for harvest was increased from 42,328 to 99,010 and percent reduction for multiple use reduced from 23% to 19% leaving an unrestricted equivalent acreage of 80,614.

2-d The economics of logging are constantly changing and all methods were mentioned even though not presently in use on the area.

3-d This sentence has been removed from the document as slash was defined in sentence above and roots are not included.

4-d Forested land and elk are not inseparable in a situation where outside disturbance is at a minimum. In forested areas timber is a very important part of the elks' life cycle. The sentence "Forested land and elk are inseparable" has been deleted since the importance of timber to elk in this area is covered elsewhere. The sentence related to importance of the Dillon area for elk hunting has been revised to read, "The Dillon area is known nationally as an important elk hunting area.

5-d The statement regarding significant historical places not being found on the SYU would meet with some opposition. The EAR states no sites are presently listed on the National Register of Historic Places. It does not preclude the fact that sites may be found which would achieve this significance. Sites with lesser significance do exist within the unit and the amount of forested base acreage removed from the allowable cut for this reason is indeed insignificant. Within our compartment planning system an inventory of areas of historical interest will be made and appropriate steps taken to protect them.

6-d The idea behind Chapter 3 covering environmental impacts is to include mention of all impacts the proposed action <u>could</u> have upon the environment. The mitigation of these impacts is covered within Chapter 4. It appears you have carefully read Chapter 3 and largely ignored the Chapter which covers mitigating and enhancing measures. We are bound by the National Environmental Policy Act to follow this format.

7-d The overloading of the forest ecosystem with a surplus of organic matter was covered on 1-21.

8-d This paragraph was removed as it did not apply to environmental impact.

9-d "The size of openings appeared to be a negligible factor of influence" is misleading; however, it is mentioned as to its relative importance when compared to human disturbance and available cover. It has been reworded accordingly.

10-d This was expanded on in Chapter 3 and a re-evaluation of restrictions made prior to the final document.

11-d This has been clarified to include other factors which may tend to interrupt the move toward a climax equilibrium. A sentence has also been added to 4-25 covering use of timber harvest as a tool which interrupts this tendency toward climax for accomplishment of desired management goals. Page 4-6 has been changed to better cover soil-slash-burning.

12-d The entire SIMIX run is being re-evaluated with more recent information as a result of public comment and the final EAR will be revised according to results of that evaluation.

Blue Ribbons of the Big Sky Country
Areawide Planning Organization

GALLATIN COUNTY

MADISON COUNTY

June 10, 1977

Mr. Jack McIntosh
District Manager
Bureau of Land Management
P.O. Box 308
Butte, MT 59701

RE: Draft Environmental Assessment Record
Timber Management Plan
Dillon Sustained Yield Unit

Dear Mr. McIntosh:

Thank you for providing us with an opportunity to comment on the subject Draft Environmental Assessment Record.

As you know, Blue Ribbons is a water quality planning program for the Gallatin and Madison River drainages which are included within the boundaries of your planning unit. However a review of a map depicting lands administered by BLM indicates that probably less than 1% of your lands are within our planning area. Analysis of the Draft reveals that you intend timber management on approximately 25% of your lands. Specific lands intended for timber management are not detailed in the Draft, but review of the text leads us to surmise that the locations of these lands are known. In any event, we have concluded that even though we do not know where you intend timber management, only a small portion of that management will occur within our area of interest.

Blue Ribbons is developing a Land Capability System which is applicable to forest lands. Through this system we hope to be able to take "Best Management Practices" (BMP's), such as included in the text of your draft, and apply them more specifically and/or to varying degrees to individual land units. Our system is not yet complete but we are able to draw certain conclusions at this time. Some of these conclusions which are applicable to portions of your lands are listed below:

1. The cretaceous sedimentary materials, which are present in the Madison Range from Jack Creek south to Hebgen Lake and to a lesser degree in the northerly portion of the Gravelly Range, are the least capable soils within our planning area.

2. Many of these areas have sufficiently high hazards to prohibit any land uses what-so-ever and the balance of these lands require utilization of much more conservative and refined management

practices than have been used in the past in order to "preserve and protect" our water quality.

3. Prior to any timber management of these lands, detailed soils and geologic investigations should be conducted.

At such time as we complete our land capability system we will transmit it to you for use in your planning. In the meantime we would like to review all compartment development plans (site specific silvicultural plans) which are prepared prior to logging within our planning area.

In conclusion, we would like to state that we are a little confused in regards to the Environmental Assessment Record - Environmental Impact Statement Process used by BLM to satisfy NEPA. It is difficult to determine the need for an Environmental Impact Statement based on the level of detail contained in the Environmental Assessment Record.

Once again, thank you for allowing us to comment and please do not hesitate to contact us should you have any questions concerning this response or desire additional information from us.

Very truly,

JOEL A. SHOUSE, P.E.
Project Director

JAS/ykm

Joel A. Shouse, P.E.
Blue Ribbons of the Big Sky Country
Areawide Planning Organization

1-e The addition of Soils Scientists to our staffs at Butte and Dillon as well as an interdisciplinary review of all sale areas assures an investigation into the soil, erosion, and water quality aspects of proposed harvest areas.

2-e We are very interested in your land capability system and will incorporate it into the planning for activity in your area as well as other areas. The Resource Areas are being informed of your desire to review and comment on our activities.

JUN 13 1977

Bureau Of Land Manageme
Butte District Office

F. H. STOLTZE LAND & LUMBER CO.

Lumber Manufacturers

Box 490 COLUMBIA FALLS, MONTANA 59'

June 10, 1977

Mr. Jack A. McIntosh
District Manager
Bureau of Land Management
P.O. Box 308
Butte, Mont. 59701

Dear Mr. McIntosh:

I am writing to comment on the Draft Environmental Assessment Record for the proposed Timber Management plan for the Dillon Sustained Yield Unit.

After spending several hours going over this E A R and the timber management plan for the Dillon sustained Yield Unit, I was very concerned about the basic data which the B.L.M. had to support the management they have proposed under this timber Management Plan.

It appeared impossible to me that you could have an area containing 171,827 acres of Commercial Forest Land and end up with a plan which would harvest only 17,343,000 board feet per decade. Considering the whole area in relation to growth, this amounts to only about 10 board feet per acre per year.

The whole plan poses more questions than it answers, as there is really no basic data included which allows one to make an objective analysis of alternatives which might be available in the management of this land.

Because of these concerns I hired Jack Alley, a Missoula consulting forester and retired Forest Service Regional timber management planner, to review the timber management plan for the Dillon Sustained Yield Unit. He spent an afternoon in Butte and talked to Dave Pickett, Chief of the Division of Resources.

I am including a copy of the report that Mr. Alley gave to me. As you can see, he raised a number of points: all of which I consider to be valid.

After reviewing Mr. Alley's report and re-reading the E A R and Timber Management Plan I can only conclude that the Timber Management Plan should be rewritten and that a full Environmental Impact Statement should be written for the new plan. The following is somewhat of a cookbook list of Concerns I have about this issue.

Mr. Jack A. McIntosh
Butte, Mont.

1-F 1. Is the commercial Forest land designation correct? Commercial Forest land is generally described as being capable of growing 20 cubic feet per acre per year.

2-F 2. How can you write a timber management plan without timber typing the ownership. Mr. Pickett told Jack Alley that there were no maps available that even showed where the Commercial timber was located.

3. Where are the land use plans referred to on page 11-2 in the timber management plan. Mr. Pickett was not able to show them to Mr. Alley. If timber management plans have to conform to land use plans, then these land use plans should be part of the E A R so that the public can make an objective judgement.

4. What about other public lands adjoining BLM lands? The timber management plan does not make any mention of co-ordinating with other government agencies on surrounding lands.

5. What is the stand condition of the Commercial Forest land, age classes, disease, insects, problem areas etc?

6. What are the impacts, biological environmental and economic from the alternatives which are available for managing these lands? In other words, you picked alternative number 12 why?

7. Where are the areas you have forest management problems and what are the conflicts in these areas.

8. If there are multiple use conflicts on this land, where and what are they?

9. What are recreation projections based on?

10 How was wildlife habitat needs arrived at or for that matter, any of the deletions and restrictions listed on page 11-5 of the timber management plan.

11. What is meant by custodial and where are the lands which will be managed under a custodial status?

12. What do you have in the way of a transportation plan for the area? Reservations for scenic corridors would indicate an unbelievable amount of road.

13. Timber management plan, section 8 is the only place that

Mr. Jack A. McIntosh
Butte, Mont.

mentioned economics. What values have been placed on the other multiple uses and how were they derived?

m.f 14. With about 130,000 acres of this area designated for Management other than timber; what consideration is being given to the future where you will have more insect and disease problems? This mortality will create aesthetic problems and liability problems in regard to fire hazard on both BLM and surrounding land.

In summary the timber management plan is totally inadequate and the E A R is of little value because it does not really tell you what the alternatives are to the proposed course of action.

Considering the federal laws you must conform to in the management of this land I see no other alternative other than rewriting the timber management plan to where it is more balanced regarding the multiple uses for the land and then writing a full environmental impact statement as is required under N.E.P.A.

Sincerely,

F.H. Stoltze Land & Lumber Co.

Royce Satterlee

Royce Satterlee
Gen. Mgr.

Royce Satterlee
F.H. Stoltze Land and Lumber Co.
Box 490
Columbia Falls, Montana

1-f Twenty cubic feet/acre/year was criteria used in this inventory.

2-f The plan is written on information derived from an extensive inventory based on aerial photo interpretation points and field plots. See attached letter from our Denver Service Center for further information. The inventory was designed for sampling errors of ± 5% on area and ± 10% on volume.

3-f Land use plans are available in our Area offices at Dillon and Butte.

4-f Our Compartment Development Plans prepared prior to harvest are an intensive evaluation on a site specific basis. They will require close cooperation with adjacent landowners.

5-f The extensive inventory gave us figures on age classes which can be broken down by counties, legal descriptions, size classes, etc. The smaller these figures are broken down, the greater the chance for error. Disease and especially insects are identified problems to timber management on the unit. The Bureau is closely coordinating with Forest Service surveys. See table added to Chapter 2 - Vegetation.

6-f Alternative 12 was picked by District personnel as being the best approach in 1974 to a timber sale program compatible with information, or lack of, on other uses. Your comments and others - primarily from industry - have warranted another look with the thinking and information available in 1977. Changes are reflected in the revised plan.

7&8-f We have maps available in the Area office at Dillon containing information on conflicts with other uses. These maps were the result of interdisciplinary review of each prepared portion of the planning system. A more detailed explanation of the hows and whys of acreage restrictions is contained in our letter following the Timber Management Plan.

9-f Recreational restrictions are based largely on present use knowledge and acreage withdrawn by recent legislation for roadless review.

10-f Wildlife was evaluated in the same manner as other uses. With recent review considerable changes were made regarding these restrictions.

11-f Custodial lands were on the merchantable low end of yield capability (low 20's cu. ft./acre/yr.). They have been restored to the base unless another restriction was applied.

12-f We have a tentative 10 year sale plan. Note explanation of re-evaluation of scenic corridors on attached letter - end of Appendix 2 as errors were found here.

13-f Values on all land uses are difficult to discern. Information was incorporated into our planning system which existed at time of preparation. Land restrictions were made more on an environmental concern and existing use pattern rather than economic although it is impossible to divorce completely one from the other.

14-f The re-evaluation of 1977 should answer some of this question as approximately 40,000 previously restricted acreage has been restored to the timber base. We have serious insect and disease problems and control through management is an important part of our yet minor program. There are no cure-alls for these problems.

TABLE OF CONTENTS

A REPORT ON THE
DRAFT ENVIRONMENTAL ASSESSMENT RECORD
FOR THE TIMBER MANAGEMENT PLAN
DILLON SUSTAINED YIELD UNIT
BUTTE DISTRICT

Bureau of Land Management

United States Department of the Interior

Jack R. Alley

Consulting Forester

Missoula, Montana

June 1977

The adjustments made in the commercial forest land base for "multiple-use" far exceed any that I have knowledge about except for areas subject to study for possible wilderness classifications. According to the report less than 3,000 acres, classified as commercial forest land, is being considered for possible wilderness classification. Out of a total of 171,827 acres of commercial forest only 12,092 acres (7 percent) are available for timber production without yield reduction for other uses. An additional 30,236 acres (17.5 percent) have a reduction of yield in excess of 25 percent for correlation with other uses. Out of the 171,827 acres of commercial forest, 129,499 (75.4 percent) are removed completely from commercial timber production.

These data seemed so unrealistic that I spent much of my time with Dave Pickett discussing how the land areas of various other uses were determined and how the conflicts in uses were resolved. I came away with the feeling that very little documentation exists to show how the land management allocations and adjustments were made.

The majority of my comments have to do with land allocations and coordination of uses as presented in the timber management plan and the environmental assessment record. These, and other comments are listed in the section immediately following. They are discussed in more detail in the subsequent section.

The items listed are not necessarily in the order of importance that I attach to them.

I. INTRODUCTION

I have reviewed the draft Environmental Assessment Record for the Timber Management Plan on the Dillon Sustained Yield Unit. The Assessment Record was prepared by the Butte District staff of the Bureau of Land Management - U.S. Department of the Interior.

In addition to reading the text I spent an afternoon with Mr. David Pickett, Chief of the Division of Resources, Butte District, B.L.M. Mr. Pickett was in charge of the field timber inventory from which the new plan was developed. He is quite familiar with the new plan and the Environmental Assessment Record, although, he was not a member of the team that prepared the E.A.R.

The chapters of the E.A.R. discussing the environment, the environmental impacts of the proposed action, mitigating or enhancing measures, and residual adverse impacts are very similar to the material in other environmental statements that deal with the harvesting of timber.

The focal point is the timber management plan which is included in the appendix to the report. The timber management plan is very brief and, according to Mr. Pickett, is intended to be a narrative statment that supports the computer calculation of timber harvest.

I have serious reservations about the timber management plan in three general areas. These include: (1) utilization standards, (2) multiple use land allocations and timber use reductions, and (3) compilation and application of the timber inventory data in the development of allowable harvest by decade. I might add here that the timber inventory appears to have been well planned and carried out using procedures developed by the Intermountain Forest and Range Experiment Station, U.S. Forest Service.

III. DISCUSSION OF SUMMARY STATEMENTS

A. Utilization standards used to compute the allowable harvest are much less restrictive than current Forest Service standards in the same area and less than the utilization already in use by local sawmills.

Compilation of the timber inventory and calculation of the allowable harvest was based on an 8 inch diameter for lodgepole pine to a 6 inch top, and an 11 inch diameter with a variable top for all other species.

On the national forest lands that surround B.L.M. lands the minimum utilization diameter for lodgepole pine is 7 inches for all other species 9 inches.

The 1969 inventory of the Beaverhead National Forest indicated that 17.7 percent of the board foot volume (Scribner) on the forest was in the 9.0 inch-10.9 inch d.b.h. class. Over one-half of the cubic foot volume was in trees less than 11 inches in diameter. Although the Beaverhead Forest has a larger proportion of lodgepole pine than adjacent B.L.M. lands, increasing the utilization requirements on the Dillon Sustained Field Unit should increase allowable harvests significantly. It should also improve the silvicultural opportunities in the selection of trees for harvest.

B. Allocation of the commercial forest land base to other use categories has not been accomplished by acceptable or statistically sound methods.

The summary statement for the E.A.R., page 1, says "The B.L.M. completed a multiple-use oriented evaluation of these lands in 1974." Page 4 of the timber management plan states that "Completed land use plans covering the entire unit have reduced the base as follows: . . . . ." From these two statements I concluded that areas had been delineated on

II. SUMMARY STATEMENT

A. Utilization standards used to compute the allowable harvest are much less restictive than current Forest Service standards in the same area and less than the utilization already in use by local sawmills.

B. Allocation of the commercial forest land base to other use categories has not been accomplished by acceptable or statistically sound methods.

1. Based on the 42,328 acres on which timber management can be carried out, there is an excessive area of roadside corridors.

2. Using the partial cut silvicultural systems prescribed in the timber management plan the amount of area set aside for "scenic corridors" is overstated.

3. More than one-third of the commercial forest land has been completely withdrawn from timber production for watershed and wildlife habitat with no explanatory data.

C. The "multiple use reduction factor" seems excessively high considering the silvicultural systems being applied.

D. There is not data available to the reviewer that describes timber stand conditions.

E. There are some inconsistencies in the development of the harvest schedule by use of the computer.

Inventory data on game use, recreation, or other multiple-use considerations may have some relationship to the field plot where timber measurements were taken. On another plot in the same stratum, however, there may be no correlation at all.

Some apparent inconsistencies in the multiple use data base are described below:

1. Based on the 42,328 acres on which timber management can be carried out, there is an excessive area of roadside corridors.

The Dillon Sustained Yield Unit has no overall transportation plan or map of a projected road system. Therefore, I had to try to rationalize whether the area set aside for roadside corridors was realistic. In my opinion, too much area from the commercial forest land base has been designated as roadside corridor and removed from possible timber harvest.

Roadside corridors, for the most part, are used to shield cutting areas from the view of the traveling public. It follows, then that if there is not cutting in an area there should be no need for areas designated as roadside corridor. Under this premise, we can assume the 13,000 acres of roadside corridor are closely related to the 42,000 acres of forest land to be harvested under the plan.

If we also assume that a three chain strip on either side of a road will provide an adequate buffer strip, the 13,000 acres delineated as roadside corridor will provide for 270 miles of road.
$(13,000 / \frac{6 \times 80}{10} = 270)$

The density of system road to accommodate 270 miles in 42,000 acres exceeds four miles per section. This is an excessive amount of system road.

In the development of the area set aside as road corridor

maps or overlays to show key values and possible use conflicts. Pickett said, however, that this wasn't the case; that no maps were available to indicate areas of common or conflicting use.

The information on other uses from which land allocations were made was largely gathered as an adjunct to the timber inventory field plots. On each of the 200 field plots for the timber inventory additional data pertaining to other resources was taken by the timber inventory crews. The specialists in wildlife, range, recreation, watershed, etc., did not participate in the field inventory. However, the information gathered apparently was the primary source material with which timber activities and other uses were correlated.

Since no maps were available to classify areas by use values, I assume that much of the area expansion for the "multiple-use oriented evaluation" of the District had to be accomplished by use of the timber inventory plots. There is no way that any statistical significance can be given to areas of land-use developed from timber inventory plots.

The timber inventory field plots were selected from a number of photo points that had been classified as to stand height and stand density. The classification criteria consisted of whether stands were more or less than 40 feet in height and several stand densities. No attempt was made to classify the photo points by species. From each stratum of similarly classified points a random sample was drawn for field sampling. Since all the photo points in a particular stratum had the same height and density classification, there obviously should be a good correlation as far as timber volume and other timber characteristics are concerned. However, it would be surprising if this method of classification provided any significant correlation for other land uses. A sample inventory for winter game range, for example, would not use this type of photo point classification.

the harvestable area by forty percent.

C. The "multiple use reduction factor" is excessively high considering the silvicultural systems to be applied.

As explained by Dave Pickett, the computer program used to develop allowable harvest removes 30 percent of the volume (over 11 inch d.b.h.) on those acres cut each decade by the SHELTERWOOD method, projects the growth on the remaining volume for a ten year period at which point one-half the remaining volume is "removed", then projects the growth on the remainder for ten years at which time all trees meeting the merchantability specifications - 11 inch d.b.h. - are removed. The ten year entry intervals are fixed in the computer even though in actual practice they may be longer.

Dillon District personnel belive the ten year entry interval is too short in some instances to provide for adequate regeneration. Since the entry interval may be lengthened the "multiple use reduction factor" was used to compensate for any volume losses that would occur.

I belive there are two major factors District personnel ignored in establishing reductions that range as high as 30 percent!

First, The District failed to consider that no additional growth was provided by the computer if the entry interval exceeded ten years. Growth data from the computer were projections of current growth on residual trees but only for ten years between each harvest. If the tree remains on the site for fifteen years, we should expect fifteen years additional growth.

Second, no consideration was given to trees that occupy the site and continue to grow but will not make 11 inch d.b.h. during the harvest cycle. With periodic light cuts of the kind contemplated by the plan, the residual stand should grow better if for no other reason than removal of competition. A more appropriate way to have handled this would have been an extension of the rotation.

no projections of anticipated use were made. All system roads are to be treated the same as far as road corridors are concerned regardless of the amount of use they will receive.

2. Using the partial cut silvicultural systems prescribed in the plan, the amount of area set aside for "scenic corridors" is overstated.

The timber management plan proposes an annual harvest of about 830 acres during the first decade. Of these acres only 44 (6 percent) will be clearcut, the remaining 786 acres to be partially cut by use of a shelter wood silvicultural system. Based on the statistics in Table 3, Appendix II, only 2,700 board feet per acre (Scribner) will be removed. This is expected to be about 30 percent of the volume of trees larger than 11 inch d.b.h.

With something considerably less than 30 percent of the total volume being removed and with the area to be regenerated prior to any further harvest, it would seem that 13,000 acres of "scenic corridor" is far to much.

3. More than one-third of the commercial forest land has been completely withdrawn from timber production for "watershed" and "wildlife habitat" with no explanation.

Forty percent of the commercial forest land has been reserved from cutting for watershed or wildlife habitat. In my discussion with Dave Pickett I tried to determine the specific reason such large areas were withdrawn. Dave couldn't say. He thought most of the wildlife habitat areas were related to winter range and the watershed areas tied to southerly exposures. Without a map to indicate where the areas are and without further detail it is impossible to say anything except to ask how such figures were developed. Certainly anyone reviewing the E.A.R. is entitled to a detailed explanation for an action that reduces

volume by forcing sufficient acreage at various volume levels through in each decade to maintain an exact evenflow. This has the disadvantage of a wide range of harvested acres decade by decade.

I am not aware of how the computer handles intermediate cut volumes. If it is expressed as a percentage of the regeneration cut volumes it is probably satisfactory. If it is based on the 11 inch minimum merchantability standards it could be understated considerably. A copy of the printout should be attached to the T.M. plan.

D. <u>There is no data available to the reviewer that describes timber stand conditions.</u>

Neither the environmental report nor the timber management plan provide any information on stand conditions, mortality, age class, size distribution, growth, etc. All of this information should have a direct bearing on calculation of allowable cut, silvicultural systems, priorities for harvest, etc.

The section of the plan describing the results of economic analysis does not provide any information on volume per acre expected to be harvested in the situations described. There is no way to follow this analysis.

E. <u>There are some inconsistencies in the development of the harvest schedule by use of the computer.</u>

I am not familiar with the computer program (SIMIX) used to develop harvest volumes for 400 years into the future. The comments that follow are based on a brief observation of the computer output and a short discussion with Pickett.

The rotation period established in the plan for timber harvest is 120 years. The computer program lists by decade the maximum age of trees that will be cut during that decade. One would assume that by the end of the second rotation timber harvest would be confined to trees at or only slightly older than 120 years. Instead, the computer printout shows that in the last decade (390-400 years from now) timber harvest is still tied to trees 160 to 200 years old. Something is wrong but it would take more investigation to determine what it is.

The computer program develops a schedule of harvest that is 100 percent volume controlled. The harvest volume for the first decade, the fortieth decade, and all the ones in between are the same. It apparently controls on

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
DENVER SERVICE CENTER
DENVER FEDERAL CENTER, BUILDING 50
DENVER, COLORADO 80225

IN REPLY REFER TO
5240 (D-340)

JUL 14 1977

ACTION
FILING

Memorandum

To: State Director, Montana

From: Director, Denver Service Center

Subject: Dillon Forest Inventory Unit 02
Sustained Yield Timber Management Plan and EAR

We have reviewed the comments made by Mr. Roy Satterlee, Stoltz Land and Lumber Co. and Mr. Jack Alley, Consulting Forester, Missoula, Montana, on the Dillon Timber Management Plan and EAR.

As requested in your memorandum of June 22, 1977, we have prepared a report outlining the general working procedure, and have identified some of the implications and ramifications of the forest inventory and forest simulation modeling systems.

Please call the Forestry Staff direct if further clarification on any of the points is needed in preparing your reply to Mr. Satterlee.

Dolan D. Hyle

Acting

Enclosure:
The Dillon Forest Inventory
and Allowable Cut Plan

IV. CONCLUSIONS

I believe that some major changes are necessary in the Dillon Sustained Yield Unit Timber Management Plan with corresponding revisions in the final Environmental Assessment Report.

The major change that is necessary is a review of the land use classifications and the area assigned to each. The process used to allocate land to the various uses should not be the same as the process used to develop area data for timber purposes. Some effort should be made to find ways to harvest timber in reasonable harmony with other resource use, rather than to blanket large areas with a "no timber harvest" slogan.

The timber management plan should incorporate tighter utilization requirements that more accurately reflect current utilization practices. The plan should also provide more detail on the condition of the forest and a description of the way the computer program determines harvest levels.

Even though this report is concerned exclusively about forest inventory, the double sampling scheme can apply to any other resource.

Photo Interpretation

Aerial photography, old forest type maps, USGS large scale topographic maps, and BLM Master Title Plats were used to establish ownership, location, timber strata, and other attributes of the lands designated for study. A total of 5696 photo points were measured and classified into homogeneous strata groupings. These photo point data are computerized onto master photo file computer tapes.

Field Plot Selection

A total of 488 field plot locations were randomly selected from the stratified photo point listings. Numerous studies of various preliminary strata grouping of height classes, forest types, density classes etc., were made to obtain the most efficient combination of homogeneous classes for final field plot selection. One hundred seventy seven plots were found to represent the statistical sample for the productive forest land. These permanent 10-point plot clusters were established during the summer of 1972.

Forest Simulation Modeling Inputs

a. Plot classification

The 177 field plots, each representing approximately 975 acres of productive forest land were classified as to: site quality, forest type, age class, management potential, multiple use restrictions, yield potential, reforestation criteria, habitat, harvesting procedure, percent of idealized stocking, and numerous other categories.

b. Present Forest Conditions

Present timber stand conditions: volume, growth, site, forest habitat, etc., were analyzed through polynomial and multiple stepwise regression programs. Regression equations were developed from these data as inputs into the forest modeling (SIMIX) program.

c. Future Forest Conditions

Site, yield, forest type, forest habitat, radial increment and other studies were made to develop regression equations for these same timber stands under various levels of proposed, future intensive management. Both existing stands, and the potential of the forest acreage to grow a second, third and fourth crop, after the existing stands are harvested, were analyzed.

The Dillon Forest Inventory
and Allowable Cut Plan

Introduction

The Dillon Forest Inventory Unit, (Unit 02) was the second unit begun under the stratified double sampling procedure. Photo interpretation work was completed during the winter months of 1971-72, and field plots were established during the summer of 1972.

Detailed procedures for the development of the public domain forest inventory are available as instruction memoranda, information memoranda, field handbooks and BLM manuals.

Objectives of the Forest Inventory.

1. What is the acreage of productive Forest Land?
2. What is the productive capacity of the land available for growing timber?
3. What is the volume of standing timber?
4. What is the current annual net growth?
5. What is the present stand condition with respect to insect, mortality, and salvable material, etc.?
6. What is the potential of this land to produce useable wood fiber, with and without silvicultural treatment, and with and without multiple use considerations.

This extensive inventory information provides the resource data needed to develop an economically and silviculturally sound, overall management plan that will meet the sustained yield, even flow allowable cut policy of the Bureau, with consideration given to multiple uses.

It must be noted that the extensive forest inventory provides a statistically reliable sample of the timber resource; however, it does not provide in place data for on the ground management of individual timber stands. Second-stage in place inventory procedures are being designed for this purpose.

The Sampling Design

The sampling design used in the Bureau's Extensive Forest Inventory is a stratified double sample with estimated stratum weights. Stratified double sampling reduces the variance and improves the reliability of estimates of primary interest for a specified field sample size. The most efficiency is obtained by selecting strata along lines of recognizable land and vegetative characteristics that delineate areas of homogeneous management conditions. In addition, these management conditions relate to other items of interest, such as forest type, stand size, stocking and/or volume etc. The inventory is designed to be within a ± 5% sampling error for area of productive forest land, and within a ± 10% sampling error for total cubic foot volume at the 66% probability level.

f. Matrix Volume Adjustment

Individual field plot data loses part of it's identity when volume and growth equations are developed. Equations are formulated for (1) the forest to be placed under a clear cutting management system, and (2) for a well stocked; (b) medium stocked, and (c) poorly stocked stands which are to be managed under the 3-stage shelterwood removal system. Local normal yield equations are also developed for the same forest acreages used in the forest simulation model. These equations take into account forest type, site quality, physiographic conditions and other forest land attributes and vary according to which acreages are included in the allowable cut run.

As the present overmature, decadent, and understocked stands are harvested, decade by decade, the yield curves applied to the remaining stands and to newly regenerated stands are adjusted to reflect this cleanup and the better management practices applied. By the end of the first ten decades (100 years), or sooner, we anticipate growth and yield will approximate the amount shown on the local normal yield table. The matrix procedure also has an effect upon the incremental growth and volume harvested on the residual trees after the first and second shelterwood removal cuts.

Three Stage Harvest

Unless specified differently, the SIMIX model selects existing seedtree (poorly stocked) types of stands for priority harvesting. Second priority is assigned to intermediate types of stands and lastly, well stocked mature stands and clearcut stands are entered for the initial cut. Once a stand is entered, the second cut is programmed for 10 years later and the final cut again 10 years later.

In actual practice, twenty years between initial entry and final harvest may be too short a time period for the Dillon District. We have studied the impact of growth on residual trees if the stand entry period were extended to 15 years, then there would be extra growth on the individual residual trees; however, the residual stand would only be 1/3 to 2/3 stocked and growth would be minimal on a per acre bases. In addition, to meet the even flow concept other stands would have to be partially harvested during that decade thus growth would be lost on the substituted stands.

Modulated Cut

A series of trial and error allowable cut runs are made for each stimulation model under SIMIX. With a given set of acreage data, volume and growth equations, and a minimum cutting age, the computer program raises the decadal cut until a point is reached sometime during the 40 decade period that the forest runs out of timber available for harvesting. This harvest level is not sustainable. The next lower sustainable cut level is then printed.

d. Utilization Standards

Two levels of utilization standards are used in the simulation modeling procedure. The primary standard is the future standard. In most cases the future standard utilizes nearly all species down to 6.0 inches DBH, and to a 5.0" minimum top diameter, for trees that will produce at least an 8 ft. log. Volume is computed using the International 1/8 inch sawkerf log scale. The allowable cut is projected for 40 decades using this standard.

The SIMIX model operates on volume control; therefore, the volume harvested each decade becomes the controlling factor. Acreage to be clearcut, or entered on any of the three programmed harvest cuts of the shelterwood removal system, vary considerably from decade to decade while the volume removed remains constant (decade by decade), based on the Bureau's evenflow policy. A decision was made to harvest the oldest age classes first, as these are generally the most decadent stands. Generally overmature stands are producing little, if any, net growth.

The computer printouts show the allowable cuts based on future utilization standards for the entire 40 decades. This cut is based on yield curves as if all individual trees were cruised with the International 1/8" standard mentioned. The mature and overmature acreage programmed to be harvested the first decade is, in effect, re-cruised using the present day District cruising standards, i.e., Scribner variable-top log rule, 11.0" minimum DBH (as of 1972). The Scribner volume on the indicated cutting area for the first decade thus becomes the allowable cut for this decade. By using the International base and the Scribner conversion procedure any utilization level can be easily substituted. In old growth large diameter stands, Scribner volumes may represent 75 to 80% of International volume, while in younger, smaller diameter stands, Scribner cruises may show only 1/2 the volume of International cruises. Allowable cuts developed through the SIMIX model are thus directly correlated to the log rule and utilization standard used.

e. Rotation Period

The Bureau's SIMIX computer model does not use a fixed rotation age as does the USFS Timber RAM program. Instead, an average minimum stand age is established, below which stands will not be entered for final harvest cutting. Thus, final harvest is not allowed in stands younger than 115 years of age when the 120 minimum age class is selected. The 120 year age class minimum is the result of silvicultural studies of average site quality, diameter increment, yield capability, species growth habits, and utilization standards selected. When utilization standards are lowered, culmination of mean annual increment will be reached earlier in life, for the smaller material, and the minimum cutting age can be lowered.

Road Density

The road density required to provide an adequate tranportation system for harvesting timber products of 4 linear miles per section is not excessive, especially where forests will be under intensive forest management. While the major portion of the road system will be used only periodically for reforestation, precommercial thinning, commercial thinning and final harvest, timber production within the right of way is prohibited. For forests not intensively managed 1/2 this amount or 2 miles of road per section would probably be adequate.

Roadside Corridors and Scenic Strips

Partial cut and individual tree selection systems will cause a loss in estimated total yield estimated to range from 20 to 50 percent per acre. Scenic strips along major roads should be identified on an individual basis. In our opinion there is no reason to designate scenic strips along any of the working woods roads.

Initial Stand Entry

The model can be programmed to choose either uncut, well stocked stands or poorly stocked seed tree type of stands for harvest during the first and second decades. To obtain the same volume, this may mean a considerable difference in acreage covered annually. Money, manpower, access, protection and other factors are taken into account when deciding how harvest is to proceed. By concentrating the harvest in the oldest and lowest quality timber stands, these non-producing acreages can be put back into production faster, and overall forest yields will be increased; however, a lot more field work is involved to obtain the same volume than if prime stands were entered.

Stumpage Value

Present day (1977) stumpage (standing trees in the forest) in the Missoula area is selling for approximately $75 to $100 per thousand board feet. The remoteness of Dillon's timber resources makes their value considerably less (approximately) $35 per MBF. The appraisal and bid prices include capital investments in road construction and other cost averaging $10.00 per MBF. At a value of $35 per MBF an annual income of $35,000.00 is foregone for each million board feet reduction in the allowable cut. Using 6-1/2 percent interest rate, this represents an investment value of 35,000/0.65 = $538,461.54. Comparing the most restrictive alternative to the URA-4 level, technical and multiple use restrictions impose a reduction to the allowable cut of 10.3 million board feet per year (Scribner scale). It has apparently been assumed by management to forgo the 10.3 million board feet of timber production representing $360,000 in annual income and a value of $5,546,154.00 in favor or existing wildlife, recreation, scenic, watershed, etc., values. If income multipliers are used in determining the economic impact of timber harvesting, the value will be proportionately higher.

For example: if the present volume and age class distribution of forest stands are such, that the non-sustainable level is reached during the ninth decade then the cutting level is lowered so that nearly all of the 120 year old timber stand plus all stands 130 years old and older have been harvested. From the low point of the ninth decade, the growing stock level will continue to build up because the forest is now growing faster than it is being harvested. Consequently, mature timber starts to pile up so that by the 30th and 40th decades stands may be allowed to grow to 150-200 years of age before being harvested. With a reinventory every ten years the computed cut would probably rise in future decades when the acreage age class distribution is evened out. There is no point to adding extra information into the system now that states: "one hundred years from now begin increasing the allowable cut 1.2 percent each year until a perfect, normal forest distribution is obtained."

Intermediate Cuts (Thinnings)

Scheduled thinnings have priority over harvest of mature timber during the simulation model decadal processing. Individual thinning prescriptions are prepared for each age class of immature (under minimum cutting age) timber. Thinning volumes are computed using the International 1/8" log rule. Thinning volumes are not converted to the Scribner log rule scale. The projected cut for the first decade may be composed of both thinning volume and mature volume.

Multiple Use Restrictions

The percentage reduction in yields of harvestable timber imposed by other multiple use disciplines, i.e., wildlife, recreation, watershed, research, etc. and also technical restrictions due to industrial technology limitations, are developed at the District URA and MFP levels through the Bureau's planning procedure.

These restrictions are transferred to the inventory base quad maps from the URA and MFP planning unit maps. All restrictions are recorded onto the photo interpretation master file on the 5696 P.I. points. The restrictions are again checked later when the field plot data is examined in detail and the plot classification is done by the Districts. However, because all of the district's lands had not been completely processed through the MFP planning program, we developed the statistical sample of multiple use restrictions through examination of the nearly 200 field plot locations. The Area Managers and all Multiple Use Discipline Members were used as a team to compile the listings of overall restrictions. While these specialists did not directly participate in the forest/inventory process, they have their own inventory data on recreation sites, critical wildlife habitat areas, critical watershed areas, mineral potential extraction areas etc., and used their knowledge to anticipate results of completed MFP's.

BEAVERHEAD CHAMBER OF COMMERCE

RECEIVED
JUN 13 1977
Bureau Of Land Management
Butte District Office

P.O. Box 830 Dillon, Mt. 59725

June 10, 1977

Mr. Jack A. McIntosh, District Manager
United States Department of the Interior
Bureau of Land Management
Box 308
Butte, Montana 59701

Dear Mr. McIntosh:

The Beaverhead Chamber of Commerce would like to take this opportunity to express our views on the DRAFT environmental assessment record (EAR) for the Bureau of Land Management's timber management program in Beaverhead, Madison, Gallatin, Jefferson, Broadwater, Silver Bow and Deer Lodge counties of southwestern Montana.

Although this area contains 172,000 acres of forest land, this new draft would take 129,000 acres out of production and reduce the harvest by 25% on another 30,000 acres. This would leave only 12,000 acres to harvest with no extra restrictions. Because there are no maps available we cannot be sure where these 12,000 acres are located.

We are aware of no timber sales in this area by BLM since 1973 except a small sale in Stone Creek. Since public lands are very important to the economy of our area, we do not feel that the BLM has been doing their share in utilizing their lands.

Because of the lack of logging permits we feel the county and state are losing on taxes. 5% of timber receipts which would come back to the state and county would mean a minimum loss of $4,000.00 per year, with a maximum of $32,000.00 per year depending on the BLM management plan.

Beaverhead and Madison County are below state level of income, with Montana lower in income than the rest of the nation. Harvesting on BLM lands, which are of lower elevation, would cut unemployment rates because they can be harvested in winter and early spring. With proper BLM land management another 112 people could be employed in these areas.

We would also suggest that you harvest on some of the roadside areas so the wildlife will move back into these areas. This increased harvest would also provide grass for our very important wildlife industry but also browse for our wildlife.

livestock?

Sincerely,

Wilbur Anderson

Wilbur Anderson, President
Beaverhead Chamber of Commerce

WA/cr

Alternatives Studied

Some twelve simulation models were prepared for the Dillon Unit. The allowable cuts developed range from 15.10 million board feet annually at the URA-4 level to 2.33 million board feet annually (International 1/8" scale) for the most restrictive management alternative. These volumes are reduced by approximately 20% when converting to the Scribner log rule and present day utilization standards (as of 1972).

We have anticipated the need to develop new SIMIX runs upon completion of the public review process for all inventory units. If the classification and management input data involves a few relatively minor changes, one or two man-weeks of forestry input is sufficient to produce a revised alternative allowable cut.

Numerous reclassification updates, however, create an entirely different work load. Changes in the base acreage which are reflected in forest type, average site quality, growth and yields, multiple use restrictions and intensive management regression updates will require up to 6 weeks of forestry inputs to complete a new allowable cut run.

Francis E. Hauk

7/13/77

June 9, 1977

Bureau of Land Management
District Office
Box 308
Butte, Montana 59701

Re: 1791

Dear Sirs:

This letter is in response to the proposed timber management plan for the Dillon unit. After studying the draft environmental assessment, I would like to share with you some of my thoughts regarding the report.

Generally I find the report very negative concerning harvest operations
1-h and the local timber industry. The report dwelled on the adverse impacts
of harvesting timber making minor and temporary concerns (dust, noise,
2-h fuel spills, siltation) seem like major environmental impacts. At the
3-h same time the benefits of the timber harvest were minimized (local economy, jobs, habitat improvement, disease control, area accessability.

The report also contains misleading statements and material.

4-h A. On page 3-18 we are told that elk require an "undisturbed... habitat free from agricultural development." Since when is a timber harvest anything like grazing livestock, building fences or planting crops.

5-h B. Of the many species of endangered plants listed only a few are found in the area.

6-h C. The survey which is cited is intended to show that most Montanans are not as concerned with earning a living as they are with being able to see the pretty mountains. However, the wording of the questions makes that answer a foregone conclusion, which makes the survey worthless.

I could go on citing examples of overstatement, understatement, misleading statements and prejudiced assumptions, however it is time to get to the meat of the matter.

Why is it that only 25% of the commercial timber lands under the jur-
7-h isdiction of the BLM in the proposed area are considered under this
plan? Surely 75% of BLM's commercial forest is not unmanageable. Is
8-h it because only 25% fit the computer program? The proposed allowable
cut is ridiculously low for the amount of forested land under BLM control. The report states that the proposed 1.73 MM BF/YR will have a negligible effect on the local economy (assumption without basis).
9-h What if the allowable cut were tripled or quadrupled of that proposed. Surely that can be accomplished with sound forestry practices, without irretrievably harming the environment. That would be a ten year management plan, not a token.

Wilbur Anderson, President
Beaverhead Chamber of Commerce
P.O. Box 830
Dillon, Montana 59725

1-g Re-evaluation in August 1977 has revised restrictions. Of 172,000 acres of productive forest land 73,000 acres is 100% restricted and 18% of the remainder is restricted leaving an equivalent non-restricted forest acreage of 81,000 acres.

2-g The Bureau is actively building its timber harvest program in the Dillon area as funding and manpower permit. We are presently involved in an active post, pole and small sawlog program.

3-g Receipts from BLM sales go to the U.S. Treasury. There is no direct return to the counties. There would be, however, a significant indirect return should a substantial program become operational.

4-g An increased sales program on BLM could increase employment on the local level. It is, however, dependent upon proper funding of the program and intensive planning required by todays land management.

5-g Previous roadside restrictions were in error and have been re-evaluated. Roadside cover is important to wildlife and any harvest must consider this factor as being more critical than increased forage.

Stephen J. Flynn
2015 Selway Drive
Dillon, Montana 59725

1-h The intent of the Timber Management Plan is to produce wood products subject to principles of multiple use, sustained yield and environmental quality and protection. Its evaluation in the EAR casts a critical eye at forest practices by necessity. All aspects of the operation must be evaluated.

2-h Chapter 4 on Mitigating and Enhancing Measures allows for mitigation of impact from these mentioned concerns. They are not, in all cases, minor and temporary concerns.

3-h Economic benefits have been expanded in Chapter 3 - Environmental Impacts.

4-h This comment, if taken in context, likens the disturbance of logging to other activities of man.

5-h No comment.

6-h The survey mentioned shows trends in thought among Montanans. It was not the entire basis of this EAR.

7-h Restrictions have been re-evaluated in final document. Please note. Available base acreage has been increased from 44 thousand acres to 81 thousand.

8-h All productive forest land (capable of producing 20 cu. ft./acre/yr.) on the sustained yield unit was included in computer analysis.

9-h Recent evaluation has changed the proposed cut considerably. Note the new plan.

Cable logging is indeed a very fine way of harvesting timber, as pointed out in the report. However, the only time it will be seen around here is after we are surrounded by wilderness areas and the price of pine dimensions lumber is equal to that of black walnut.

Sincerely,

Stephen J. Flynn
2015 Selway Drive
Dillon, Mont. 59725

RECEIVED
JUN 23 1977
Bureau of Land Management
Butte District Office

STATE OF MONTANA

DEPARTMENT OF FISH AND GAME

Route 3, Box 274
Bozeman, Montana 59715

June 22, 1977

Mr. Jack McIntosh
Bureau of Land Management
Butte, Montana 59701

Dear Jack:

In reference to the BLM's timber management in the Butte District, we offer the following comment: timber types associated with the foothill country commonly found on BLM lands are generally important for wildlife. This timber usually provides protective cover adjacent to open rangeland feeding areas for big game animals and other wildlife species.

1-i Any consideration to remove this important cover source by timber harvesting should carefully consider the possible negative side affects it can have on wildlife. The Fish and Game Department strongly endorses the elk/logging guidelines presently being developed by the interagency study team in Montana. We recommend the BLM utilize these where applicable when the decision has been made to log an area.

2-i We would appreciate being informed of any plans to harvest timber in areas where significant conflicts between wildlife and logging are likely to occur.

Sincerely,

LeRoy Ellig

LEROY ELLIG
REGIONAL SUPERVISOR

LE:plj

State of Montana
Department of Fish and Game
Route 3, Box 274
Bozeman, Montana 59715

1-i Chapter 4-16 mentions use of the Elk Logging Studies in mitigating measures.

2-i You will be informed of our harvest plans.

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

Billings Area Office
Federal Building, Room 3035
316 N. 26th
Billings, MT 59101

IN REPLY REFER TO:

June 8, 1977

MEMORANDUM

To: District Manager, Bureau of Land Management
Butte, Montana

From: Acting Area Manager, USFWS, Billings, MT

Subject: Review of Draft Environmental Assessment Record (EAR) for BLM's Timber Management Program in Beaverhead, Madison, Gallatin, Jefferson, Broadwater, Silver Bow, and Deer Lodge Counties of Southwestern Montana

We have reviewed the subject record and find that it adequately describes the fish and wildlife resources of the unit area. In addition, we concur with the proposed measures to protect these resources as described in the EAR. However, we would like to mention the following:

1-j The EAR points out the existence of the endangered Rocky Mountain wolf and the threatened grizzly bear in the area. We want to emphasize the need to maintain remote habitat for their survival and to urge that logging roads into wolf or bear habitat be blocked off when logging has terminated to prevent public vehicular access.

2-j We recommend that fragile areas be avoided to prevent unnecessary damage to the environment. These areas include, but are not limited to 1) areas where regrowth would be especially slow; 2) that soil which could easily expose bare rock if the cover were to be disturbed; or 3) areas having slopes which could slide if the vegetation were to be manipulated.

We appreciate the opportunity to comment on this record.

cc: Regional Director, USFWS, Denver, CO (ENV)

U.S. Fish and Wildlife Service
Billings Area Office
Federal Building, Room 3035
316 N. 26th
Billings, Montana 59101

1-j Each action will be evaluated on its own merit. At least one professional Wildlife Biologist will review the proposed action on the ground and make recommendations accordingly. Your point on road blockage is well taken and road and access management is an important part of the document. The Montana Department of Fish and Game will also review each action.

2-j These areas have been covered within the document.

RECEIVED
JUN 23 1977
Bureau Of Land Management
Butte District Office

Champion Timberlands
Champion International Corporation

June 21, 1977

P.O. Box 434
Bonner, Montana 59823
Telephone 406 258 6161

Mr. Jack A. McIntosh
District Manager
United States Department of the Interior
Bureau of Land Management
District Office
Box 308
Butte, Montana 59701

Dear Mr. McIntosh:

I would like to compliment the personnel from the Butte District for preparing a comprehensive, well thought out, Timber Management Plan. I feel that the management guidelines formulated in the Timber Management Plan are conducive to efficient and practical field application. I am especially appreciative of the fact that the Butte District has recognized, and then not ignored the value of timber production and management.

Very truly yours,

James G. Simpson
Hellgate District Forester

jb

CHAPTER 10

INTENSITY OF PUBLIC INTEREST

Experience with public inputs and reviews in preparation of planning documents has typically shown a general interest in environmental concerns and a continuing interest in our timber management program by both the local individuals and government, plus various interest groups on the national level. However, these interests are not concerned generally with whether or not an intensive management program should be maintained or with what management practices are used, but rather are concerned with the continuing quality of the overall management job carried out by the Bureau.

Discussion of the practices involved in the proposed action has been extensive through the land use planning process in the unit as shown in Chapter 9. Emphasis has been placed on the types of practices and their impacts rather than the acres or volumes involved.

The greatest public interest is usually generated in reference to individual timber sales rather than plans of overall management practices. When a sale is in an area used by people for purposes other than timber production (hunting, etc.), the public can better identify the impacts of the proposal and offer comments.

The Draft EAR generated the most interest from those segments of industry with a direct dependence on timber in the sustained yield unit. They were very concerned about restrictions placed on the land by other uses.

The timber management plan directs that individual environmental assessments will be made for each sale in addition to this program EAR. These site specific, individual environmental assessment records could result in an environmental impact statement being prepared on a proposed

timber sale if it was determined to be a major federal action causing significant environmental impacts or having a high intensity of public interest.

GLOSSARY

1. Allowable Cut - the average volume that may be harvested annually from a given forest unit which will result in the eventual attainment and perpetuation of an approximately normal distribution of age classes, normal stocking, and sustained yield.

2. Animal Unit Month (AUM) - Used to reflect the amount of forage available to sustain a cow for 1 month.

3. Base Flow (Base Runoff) - That part of runoff composed of grounwater runoff (deep seepage) and delayed subsurface runoff.

4. Biome - a major biotic community, natural groups of organisms characterized by the occurrence of certain plants and animals that are dominant or influential.

5. Board Foot - a unit of measurement represented by a board one foot long, one foot wide, and one inch thick.

6. Canopy - the cover of green leaves and branches formed by the crowns of all trees in a forest.

7. Clearcut - A silvicultural system involving the removal of the entire standing crop of trees from a given area.

8. Climax (Species) - A plant species or community that is self-regenerating, showing no evidence of replacement, and appears to be maintaining present density.

9. Commercial Forest Land - forest land which is producing, or has a site capable of producing, at least 20 cubic feet per acre per year of commercial tree species.

10. Compartment - a logical subdivision of a Sustained Yield Unit, usually a major drainage or watershed, generally 1,000 to 3,000 acres.

11. Ecology - the study of the relationship of living organisms to each other and their environment.

12. Erosion - The wearing away of soil surface by single grain movement by some force, i.e., wind, water.

13. Esthetics (Aesthetics) - Sensitivity to natural beauty or natural conditions.

14. Evapotranspiration - Total water losses due to evaporation from surfaces and transpiration from plants.

15. Fire Management - A systematic combination of smoke management, fuels management, and fire control designed to increase the quality of land management.

16. Fish - All species of fresh water fishes, as well as crustaceans, mollusks, and other underwater organisms which are considered part of the fishery resource.

17. Forest Products - all vegetative resources grown upon or near forest lands.

18. Forest Rotation Age - the period of years required to establish, grow, and harvest stands of timber in order to best accomplish the definite objectives of management.

19. Fuel Management - Manipulation or reduction of fuels to meet forest protection and/or management objectives while preserving or enhancing environmental quality.

20. Game - Any species of wildlife for which seasons and bag limits have been prescribed, and which are normally reduced to possession by sportsmen under State laws and regulations.

21. Habitat Type - Basic ecologic subdivision of landscape having a distinctive potential as recognized by a distinct combination of vegetation.

22. Harvest Cut - the removal of a crop or stand of financially or physically mature trees as a final cut in even aged management, or the removal of mature elements of a stand in uneven aged management.

23. Infiltration - The rate at which water enters the soil surface.

24. Jammer - a log-loading machine operated either by horse or mechanical power.

25. Key Big-Game Winter Range - Those portions of the yearlong range where big game seek food and shelter during periods of deep snows and/or cold weather. It is the amount of winter range and its condition which determines the carrying capacity of the yearlong range.

26. Land Types - That portion of the landscape that has certain features peculiar to it wherever it is found. A given land type consists of certain soil, rock, and moisture conditions; for this reason, certain predictions can be made regarding its potential use and management.

27. Management Framework Plan (MFP) - a planning decision document which establishes, for a given area of land, land use allocations, coordination guidelines for multiple use, and objectives to be achieved for each class of land use or protection. It is the Bureau's Land Use Plan.

28. Productive Forest Land - Forest land which is producing or capable of producing crops of industrial wood. This includes areas suitable for management to grow crops of industrial wood generally of a site quality capable of producing in excess of 20 cubic feet per acre of annual growth.

29. Public Land (PL) - tracts of land administered by the Bureau of Land Management.

30. Replacement Snag - A cull or live tree, meeting the size criteria for snag, designated as a replacement for existing snags that are being managed as wildlife habitat.

31. Rotation (Timber Management) - The planned number of years between the formation of a stand of timber and its final cutting at a specified stage of maturity.

32. Runoff (Water Yield) - That part of the precipitation which appears in surface streams of either perennial or intermittent form. This is the flow collected from a drainage basin that appears at the outlet of the basin. May be calculated as precipitation minus evapotranspiration.

33. Selection Cutting - Removal of mature timber, usually the oldest or largest trees, either as single scattered trees or in small groups at relatively short intervals, repeated indefinitely.

34. Seral - A species or community which is replaced by another species or community as succession progresses toward climax.

35. Shelterwood Cutting - Removal of the mature timber in a series of cuttings, which extend over a period of years to allow for the establishment of natural reproduction.

36. Silviculture - the science and art of producing and tending a forest; the application of the knowledge of silvics in the treatment of a forest; the theory and practice of controlling forest establishment, composition, and growth.

37. Site - the quality of the soil, climate, and interaction of all ecological factors which determine the productive capacity of forest land.

38. Site Index - A measure of the relative productive capacity of a site for the crop or stand under study, expressed as the height of the dominant trees in a stand at an arbitrarily chosen index age. The index age base used in this plan is 50 years; therefore, a stand in which the dominant trees reach a height of 40 feet at 50 years of age has a site index of 40.

39. Slash - Branches, bark, tops, chunks, cull logs, and broken or uprooted trees left in an area after logging or other silvicultural activities.

40. Snag - A standing dead tree.

41. Status Undetermined - A species that has been suggested as possibly endangered, but about which there is not enough information to determine its status.

42. Stocking Control - Maintaining the optimum number of trees on an area for maximum timber production.

43. Succession - Gradual displacement of one plant or community of plants by another.

44. Threatened and Endangered Species - Species or subspecies of plants or animals that are so few in number or so threatened by present circumstances as to be in danger of extinction.

45. Timber - standing trees, down trees, or logs which are capable of being measured in board feet.

46. Timber Management - the application of economic factors and silvicultural principles to obtain prescribed forest management objectives.

47. Unit Resource Analysis - a comprehensive display of physical resource data and an analysis of the current use, production, condition, and trend of the resource and the potentials and opportunities within a planning unit.

48. Wildlife - All nondomesticated mammals, birds, reptiles, and amphibians living in natural environment, including both game and nongame species, whether considered beneficial or otherwise.

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APPENDIX I

ENVIRONMENTAL IMPACT ANALYSIS WORKSHEETS

APPENDIX I

ENVIRONMENTAL IMPACT ANALYSIS WORKSHEETS

The Environmental Impact Analysis Worksheets are prepared by the interdisciplinary team to identify in a matrix system the following items: proposed action, agents that cause change, environmental components, anticipated impacts. The anticipated impacts are based on the design features in the proposed action plus the mitigating or enhancing measures.

The ratings for anticipated impacts are given in the following terms of magnitude:

O = No or negligible impact
X = Unknown impact
L = Low impact
M = Medium impact
H = High impact

The ratings are based on a consensus of the specialists preparing the document. The anticipated impact ratings vary in relation to the resource being analyzed. For instance, one impact rating for landscape character is warranted if a shelterwood cutting is viewed from within a logging unit by a forester while a different perspective and impact rating might be assigned to the same logging unit when viewed from the air by a landscape architect.

The use of a matrix system assists in cross-referencing anticipated impacts on different environmental components (e.g., an action which has the impact of lowering water quality may cause an impact on fish populations, etc.).

The objective in using the worksheet is to provide a visual display of relationships to assist the writers in converting their technical material into a clear, concise, flowing narrative for use in public reviews and by responsible officials.

ENVIRONMENTAL IMPACT ANALYSIS

1. Description of the proposal
   Harvest

2. Stages in proposal (optional) — Intermediate Cuttings / Final Cuttings

3. Agents that cause change

4. Environmental Components

5. Subcomponents Impacted	Commercial Thinning	Sanitation-Salvage Cutting	Shelterwood Cutting	Selection Cutting	Shelterwood Removal Cutting	Seed Tree Cutting	Clearcutting
	6. Anticipated Impacts						
CLIMATE AND AIR QUALITY							
Air Temperature	L	O	L	L	L	M	M
Particulates	O	O	O	O	O	O	O
SOILS AND GEOLOGY							
Soil Depth	O	O	O	O	O	O	O
Soil Structure	O	O	O	O	O	O	O
Soil Nutrient	X	O	X	X	X	L	L
Erosion	O	O	O	L	L	M	M
WATER							
Sediment Load	O	O	O	L	L	M	M
Dissolved Oxygen	O	O	O	O	O	X	X
Temperature	O	O	O	O	X	X	X
VEGETATION							
Aquatic Plants	O	O	O	X	X	L	L
Grasses	L	X	L	L	L	H	H
Shrubs	L	X	L	L	L	M	M
Conifers	L	X	L	L	M	M	H
Broadleaf Trees	L	X	L	X	L	M	M
ANIMALS							
Fish	O	O	O	L	L	L	M
Mammals	X	X	X	X	X	X	X
Birds	X	X	X	X	X	X	X
PREHISTORIC AND HISTORIC	X	X	X	X	X	X	X
AESTHETICS	L	L	L	L	M	M	H
SOCIO-ECONOMIC CONDITIONS	L	L	L	L	L	L	L
LAND USE	L	L	L	L	M	L	H
ECOLOGY	L	X	L	L	L	L	H

ENVIRONMENTAL IMPACT ANALYSIS

1. Description of the proposal
   Harvest

2. Stages in proposal (optional)

   Ground Yarding | Road Construction

3. Agents that cause change

4. Environmental Components

5. Subcomponents Impacted	Horse Skidding	Tractor Skidding	Mobile Yarder Loader	Idaho Jammer	Shovel	Clearing and Grubbing	Excavation	Embankment	Finishing		
	6. Anticipated Impacts										
CLIMATE AND AIR QUALITY											
Air Temperature	O	O	O	O	O	O	O	O	O		
Particulates	O	L	L	L	L	L	L	L	L		
SOILS AND GEOLOGY											
Soils Depth	O	L	L	O	O	L	H	H	O		
Soil Structure	M	H	M	L	L	L	H	H	O		
Soil Nutrient	O	O	O	O	O	X	X	X	O		
Erosion	M	H	M	L	L	L	H	H	O		
WATER											
Sediment Load	L	M	L	L	L	L	M	M	O		
Dissolved Oxygen	O	O	O	O	O	X	X	X	O		
Temperature	L	L	L	L	L	X	X	X	O		
VEGETATION											
Aquatic Plants	L	L	L	L	L	L	L	L	O		
Grasses	X	L	X	X	X	M	M	M	O		
Shrubs	X	L	X	X	X	H	M	M	O		
Conifers	X	L	X	X	X	H	M	M	O		
Broadleaf Trees	X	L	X	X	X	H	M	M	O		
ANIMALS											
Fish	L	L	L	O	O	L	L	L	O		
Mammals	X	X	X	X	X	L	X	X	L		
Birds	X	X	X	X	X	L	X	X	X		
PREHISTORIC AND HISTORIC	X	X	X	X	X	X	X	X	X		
AESTHETICS	O	L	L	L	L	O	O	O	L		
SOCIO-ECONOMIC CONDITIONS	L	L	L	L	O	O	O	O	L		
LAND USE	O	L	L	L	O	O	O	O	L		
ECOLOGY	O	L	L	L	L	O	L	L	L		

ENVIRONMENTAL IMPACT ANALYSIS

1. Description of the proposal	Harvest	Slash
2. Stages in proposal (optional)	Road Maintenance	Slash Disposal

3. Agents that cause change

4. Environmental Components — 5. Subcomponents Impacted	6. Anticipated Impacts: Surface Maintenance	Shoulder Sideslope & Roadslide Maint.	Drainage Maintanence	Prescribed Burning	Mechanical Treatments	Isolation & Limited Treatments	Better Utilization				
CLIMATE AND AIR QUALITY											
Air Temperature	O	O	O	X	O	O	O				
Particulates	L	O	O	H	L	O	O				
SOILS AND GEOLOGY											
Soil Depth	O	O	O	O	O	O	O				
Soil Structure	O	O	O	O	O	O	O				
Soil Nutrient	O	O	O	M	X	O	L				
Erosion	O	O	L	O	O	O	O				
WATER											
Sediment Load	O	O	L	X	X	X	O				
Dissolved Oxygen	O	O	O	O	O	O	O				
Temperature	O	O	O	O	O	O	O				
VEGETATION											
Aquatic Plants	O	O	L	X	X	X	O				
Grasses	O	L	O	L	O	O	O				
Shrubs	O	L	O	M	O	O	O				
Confiers	O	O	O	X	O	O	O				
Broadleaf Trees	O	O	O	X	O	O	O				
ANIMALS											
Fish	O	O	L	X	O	O	O				
Mammals	O	O	O	L	L	X	L				
Birds	O	O	O	X	X	X	X				
PREHISTORIC AND HISTORIC	X	X	X	X	X	X	X				
AESTHETICS	O	O	O	L	L	L	L				
SOCIO-ECONOMIC CONDITIONS	O	O	O	O	O	O	L				
LAND USE	L	L	L	X	O	O	L				
ECOLOGY	O	O	O	M	L	O	O				

ENVIRONMENTAL IMPACT ANALYSIS

1. Description of the proposal: Development | Protection

2. Stages in proposal (optional): Development | Prot. | Insect Control | Diseas Contro

3. Agents that cause change

4. Environmental Components — 5. Subcomponents Impacted	Tree Improvement	Site Improvement	Regeneration	Precommercial Thinning	Suppression	Prevention	Silvicultural Control	Physical Control	Silvicultural Control	Physical Control
(Stage)	Development				Prot.		Insect Control		Diseas Contro	
	6. Anticipated Impacts									
CLIMATE AND AIR QUALITY										
Air Temperature	O	L	O	X	L	L	O	O	O	O
Particulates	O	L	O	O	H	H	O	O	O	O
SOILS AND GEOLOGY										
Soil Depth	O	L	O	O	O	O	O	O	O	O
Soil Structure	O	L	O	O	X	X	O	O	O	O
Soil Nutrient	O	L	O	X	X	X	O	O	O	O
Erosion	O	L	L	O	L	L	O	O	O	O
WATER										
Sediment Load	O	X	L	O	L	L	O	O	O	O
Dissolved Oxygen	O	O	O	O	X	X	O	O	O	O
Temperature	O	O	O	O	L	L	O	O	O	O
VEGETATION										
Aquatic Plants	O	X	L	O	L	L	O	O	O	O
Grasses	O	M	L	L	L	L	O	O	O	O
Shrubs	O	M	L	L	L	L	O	O	O	O
Conifers	M	M	H	M	L	L	L	L	L	L
Broadleaf Trees	O	M	L	L	L	L	O	O	O	O
ANIMALS										
Fish	O	X	X	O	L	L	O	O	O	O
Mammals	O	X	X	X	X	X	X	X	X	X
Birds	O	X	X	X	X	X	X	X	X	X
PREHISTORIC AND HISTORIC	X	X	X	X	X	X	X	O	X	O
AESTHETICS	L	L	L	L	L	L	L	L	L	L
SOCIO-ECONOMIC CONDITIONS	L	L	L	O	M	O	L	L	L	L
LAND USE	L	L	H	L	M	O	L	L	L	L
ECOLOGY	L	L	L	O	M	O	X	X	X	X

APPENDIX II

TIMBER MANAGEMENT PLAN
FOR THE
DILLON SUSTAINED YIELD UNIT

APPENDIX II

TIMBER MANAGEMENT PLAN
FOR THE
DILLON SUSTAINED YIELD UNIT

SEPTEMBER 1977

BUREAU OF LAND MANAGEMENT
U.S. DEPARTMENT OF THE INTERIOR

TABLE OF CONTENTS

TIMBER MANAGEMENT PLAN

FOR THE

DILLON SUSTAINED YIELD UNIT

LIST OF TABLES AND APPENDICES

SUMMARY OF TIMBER MANAGEMENT PLAN

The role of forests in maintaining a quality environment and meeting growing demands for many other forest uses beyond timber production are a part of awakened environmental concern. At the same time, the nation's demand for more wood products continues to increase with population and economic growth.

A portion of the public lands in the Butte District have been designated as the Dillon Sustained Yield Unit for purposes of timber management planning. The SYU contains public lands in Jefferson, Broadwater, Deer Lodge, Silver Bow, Madison, Gallatin, and Beaverhead Counties. In this plan, it is referred to as the Dillon SYU. The primary forest production objective in the Dillon SYU is to produce wood products from forested lands classified as available for timber production subject to the principles of multiple use, sustained yield, and environmental quality and protection. Such an approach has been taken in our land use plans and our policies and procedures for timber management planning. The key to this approach lies in asking first the question of environmental feasibility, and then the question of economic feasibility in the development of forest management plans and programs.

I. PURPOSE

The purpose of this report is to present the results of the application of timber management planning policies and procedures to the recently completed reinventory of the Dillon SYU. Fourteen harvest level alternatives were run and analyzed, as shown on Table 1. Alternative #14 was selected as the highest level of sustained timber protection that can be achieved within environmental and economic constraints.

A reexamination will be made at a minimum of ten year intervals or more frequently if needed. Until a careful reexamination is made, the sustainable harvest level will remain as decided upon in 1977.

TABLE 1

FINAL SUSTAINABLE HARVEST ALTERNATIVES
AND MULTIPLE USE FACTORS

Harvest Alternative	Int 1/8	Scrib. Dist. Rule	Multiple Use Red. Factor	Final Multiple Use Sust. Harvest Level	Base Acres
	Sustainable Harvest Volumes M bd ft/Decade				
1/			2/	Scrib Log Rule	
1 URA-3-W/O(a)	158,900	112,200	0	112,200 M/Decade	171,800
2 URA-4-W(b)	171,900	121,400	0	121,400 M/Decade	171,800
3 MFP-2-Dist W/O	57,500	46,100	.29	32,800 M/Decade	86,500
4 MFP-2-Dist W	79,300	63,000	.29	44,700 M/Decade	86,500
5 MFP-2-Cent W/O(c)	41,200	33,400	.24	25,400 M/Decade	70,600
6 MFP-2-Cent W	50,600	40,900	.24	31,100 M/Decade	70,600
7 MFP-2-Bl.Ta.W/O(d)	54,300	42,900	.28	30,900 M/Decade	79,700
8 MFP-2-Bl.Ta.W	68,700	54,400	.28	39,100 M/Decade	79,700
9 MFP-2-Ruby W/O(e)	58,400	46,900	.30	32,800 M/Decade	82,600
10 MFP-2-Ruby W	75,500	60,000	.30	42,016 M/Decade	82,600
11 MFP-2 ALL W/O(f)	23,300	19,000	.23	14,631 M/Decade	42,300
12 MFP-2 ALL W	27,500	22,500	.23	17,343 M/Decade	42,300
13 MFP-2 ALL W/O(g)	75,300	52,600	.19	42,800 M/Decade	80,614
14 MFP-2 ALL W(h)	95,000	67,100	.19	54,600 M/Decade	80,614

1/ This is the district's final decisionmaking level expressed in the Scribner log rule.

a. W/O = Without Intensive Management
b. W = With Intensive Management
c. Cent = Centennial Range Acreage Excluded
d. Bl. Ta. = Black Tail Range Acreage Excluded
e. Ruby = Ruby Range Acreage Excluded
f. Centennial, Black Tail and Ruby Acreages Excluded
g. Revised 8/77 with restrictions
h. Revised 8/77 with restrictions

2/ This is a percentage reduction in yield of those areas where forest management practices are restricted due to other use considerations.

Coordination With the MFP (Land Use Plan

Portions of the planning unit land base that are suitable for commercial forest production are identified in the Unit Resource Analysis (URA), Step 4. The URA is the inventory phase of the BLM's planning system. They are also identified in Step 1 of the Management Framework Plan (MFP) process which lists the activity recommendations for full

timber production. In Steps 2 and 3 of the MFP process, this activity recommendation is tempered by policy, environmental considerations, and multiple-use considerations. This results in a generalized zoning of the planning unit which identifies portions of the commercial forest land base which are available for intensive timber production, portions of the commercial land base on which management practices must be tempered because of environmental or multiple-use considerations, and portions of the commercial forest land base which are not available for timber production because of the same considerations. See Table 2 (Timber Management Plan) for detail on forest management guidelines and restrictions.

Findings

The basic conclusion reached is that there will be fewer acres on which timber production can be the primary objective, and that more money and effort must be spent on environmental protection and support of non-timber uses than in the past. The commercial forest land base has been reduced from 171,733 to an equivalent of 80,614 acres, a reduction of 53.1 percent. At the same time, the reduced commercial forest land base has the potential for higher timber production/available acre through intensive management practices. The major findings are as follows:

1. Commercial Forest Land Base — Multiple Use and Environmental Restrictions

The commercial forest land base is substantially larger than the acreage available for full timber production. The commercial forest land base is 171,733.27 acres. Completed land use plans covering the entire unit have reduced the base as follows:

TABLE 2

DELETIONS AND RESTRICTIONS AFFECTING THE COMMERCIAL FOREST LAND BASE

*RESOURCE RESTRICTION	100% RESTRICTION (No Cutting)	*PARTIAL RESTRICTION (Acres with Partial Reduction in Yield)
Wildlife Habitat	2,905	26,242
Streamside Protection	2,939	1,952
Watershed	2,925	20,738
Scenic Withdrawal	--	3,938
Recreation	--	978
Topographic	36,158	--
Roadless Study	27,796	--
Subtotal	72,723 acres (a)	53,848 acres
No Restriction	45,162 acres	
Total	117,885 acres	53,848 acres (b)

Total Base Acres = 171,733

45,162 No Restriction
+53,848 Partial Restriction
99,010 Total acres available for forest management

*Where overlaps in restrictions occurred, the major percentage restriction carried precedence over minor, e.g., if a given plot were 50% restricted for watershed reasons and 100% restricted for wildlife it would be recorded for major restriction or 100% for wildlife.

(a) Some of these acres will be deferred indefinitely while others may be reinstated to the base acres or reevaluated at some future date pending changes in other resource values and/or technology. This acreage is now deducted from the productive forest base.

(b) To account for yield reduction for partial restrictions an 18.58% reduction is made in the allowable cut developed from the 99,010 acres of productive forest land in the SYU.

The equivalent nonrestricted forest acreage is now 80,614 acres.

Technical and multiple use restrictions prohibit harvesting on an equivalent of 53.1% of the productive forest acreage in the Dillon Forest Inventory Unit.

2. Timber Management Plan

The final timber management plan volume (Harvest Alternative #14) was computed on International 1/8 Log Rule[a]. The harvest volumes are converted to Scribner Log Rule[b]. The commercial thinning volumes should be kept in International 1/8 measure but to lessen confusion, the mature and immature volumes are combined.

[a]International 1/8 Log Rule measurements are more accurate in reflecting the actual log volumes in board feet than the Scribner Log Rule, expecially for small diameter trees.

[b]Scribner Log Rule use results in volumes comparable to those found by the International 1/8 in measuring larger diameter logs; use of the Scribner Log Rule on smaller diameter logs results in readings of lower volumes than with use of the International 1/8. The Scribner Log Rule has historically been used for timber cruise and sale on the Dillon SYU.

Since year-to-year harvest balance between mature and commercial thinning volume fluctuates considerably, the first 20 decades were evaluated and averaged.

Available for harvest

A total volume of 77.349 MM bd. ft./decade (International 1/8) is available of which 11.860 MM bd. ft is in thinnings. Subtracting the thinning volume of 11.860 MM bd. ft. from the total available of 77.349 MM bd. ft. leaves 65.489 MM bd. ft./decade (International 1/8) in mature volume.

The 65.489 MM bd. ft./decade (International 1/8) of mature volume is converted to Scribner Log Rule by use of a .706 factor. This results in 65.489 MM bd. ft. x .706 = 45.812 MM bd. ft./decade (Scribner).

When the total volume of 77.349 MM bd. ft./decade (International 1/8) is converted by the .706 factor, this results in 54.6 MM bd. ft./decade (Scribner). Material harvested in precommercial size classes for posts, poles, etc. does not contribute to this volume.

3. Intensive Management Input to Timber Management Planning

The intensive management practices considered for the Dillon SYU increase the base management level by 11.86 MM bd. ft./decade International 1/8. Practices evaluated in the computer model were precommercial thinnings and commercial thinnings. For each of clearcut and partial cut regimes, three intensive management options were available. They are guides and best estimates for actual management options available in the field. They are:

Clearcut 1. Precommercial thinning only
2. Precommercial followed by commercial
3. Commercial thinning only

Partial cut (same options as clearcut but possibly different age classes)

Only options 2 and 3 were considered as it was determined precommercial thinning only was not economically feasible. This is not to preclude precommercial thinning on a site-by-site basis as intensive forest inventory information may show. Tree planting was not considered an intensive management practice. Planting will still be done on a silvicultural basis but does not contribute to the intensive management volume increase. The practices outlined were found to be environmentally and economically feasible, and additional production through their added growth rates is based on full implementation of these practices through sustained funding.

4. Alternative Programs and Future Flexibility

The program presented represents a full level effort. In view of national timber needs and the importance of environmental protection, no reduced effort can reasonably be proposed. After an intensive inventory of appreciable SYU acreage it may be necessary to recompute the cut. As additional knowledge is gained through intensive resource inventories it may be

necessary to add to or subtract from the productive base acreage. Also, formal classification of lands for other resource protection, after public participation through the planning system, may require further adjustments in the forest land base. Timber management planning policies contain the flexibility to make such adjustments when needed. The BLM forest model computer program will permit calculations to be run on reasonably short notice.

II. INTRODUCTION

1970 marked the beginning of a decade of awakened environmental concern. Across the nation support is building for realistic efforts to halt environmental destruction and to restore damage already done. Forests are recognized as an especially valuable part of the environment to be protected. The argument that increased production of timber is needed for homes and economic health is no longer accepted without question. An unwillingness to compromise the forest environment is found in today's communities and reflected in the Congress.

At the same time, the nation's population and economic growth continue upward. The demand for wood products continues apace with it. The ability to meet this growing demand for wood from the forest resources of the nation is in some doubt. Under present levels of management intensity, timber production is projected to begin falling short of needs by 1985, with development of a significant supply gap by 2000.

The objectives of full forest production to meet wood needs and the managing of forest to protect environmental values can be met with a balanced, rational approach. The key concept is to first ask the question of environmental feasibility and then the question of economic feasibility. This is the approach taken in the Dillon SYU Timber Management Plan. For the Dillon SYU, a potential for some degree of forest harvest lies in 99,010 acres of forest land in the unit. These forests also represent part of Montana's forest lands of key importance in maintaining an environment of stable soils, clean water, productive fisheries, wildlife habitat, recreation days, and enjoyable landscape.

Even though these forest lands are capable of producing approximately 5.46 MM bd. ft. (Scribner) annually, an average of only 300 MBF have been harvested since 1970. Some intensive practices such as commercial thinning, and sanitation thinning, are presently standard procedures. However, acres treated each year are not sufficient to

maintain the recommended harvest level. Multiple-use management, providing for other forest resource uses and environmental protection, is carried out to the extent possible under current resource knowledge, technology, and funding. This timber management plan develops new data on forest resource conditions, multiple-use, and environmental protection needs. Its findings are that there will be less acres on which timber production can be the primary objective, and that more effort and money must be devoted to the environment and careful timber management planning. The plan also indicates that the remaining commercial forest land base has potential for increased timber production per acre to offset partially that production which now must be foregone for other uses.

Preparation of this plan had its beginning 1970, when the Bureau of Land Management began development of a public domain timber management program that was responsive to multiple use needs, sound forest conservation, and the fullest level of timber production feasible through an extensive reinventory of the public lands. The Dillon SYU was the second of 18 areas in the western United States to be selected for this inventory.

III. SCOPE

This report encompasses all the inputs entering into the computation of a Dillon SYU timber management program needed for its implementation. The following components are covered:

- New inventory results and methods with explanation of differences in relation to the previous inventory.
- The new potential management plan with explanation of policies and procedures used in its calculation.
- Key non-timber use values and environmental protection steps taken to implement the proposed timber management plan.
- Economic analysis used in determining levels of intensive forestry practices entering into the allowable cut computation.
- Program requirements necessary for implementation of the management plan.

Full indepth treatment of each of these components would require five separate and substantial reports. Therefore, this report employs condensed summaries of its components, giving reference to more complete treatments where needed. However, some of the economic analysis is attached as an appendix.

3. Policy - Multiple Use Considerations. The allowable cut shall relate to commercial forest land judged to be suitable and available for wood production. Forested lands managed for aesthetic, recreational, watershed, wildlife habitat, or other uses, to the exclusion of timber cutting, shall not be included in the commercial forest base. The allowable cut shall also reflect the effects of multiple use management of lands judged to be suitable and available for wood production.

Implementation. Based on inventories and land use plans, those lands which are not available for cutting in order to assure protection and enhancement of other forest resource values and uses were identified and excluded from the timber management base. Additionally, the cut was reduced to reflect special cutting practices necessary to protect and enhance other forest resource values and uses when these practices affected wood growth and yield. The types of land use classifications which were identified and accounted for in developing the proposed timber management plan include intensive use recreational areas, scenic corridors, scenic areas, wildlife habitat, streamside corridors, critical watersheds, buffer zones, damageable sites, and designated primitive areas.

4. Policy - Planning Horizon. The determination of the allowable cut shall represent the planning of the wood production segment of the future forest management program. In making the necesary forecasts, the planners shall look far enough ahead so as to take into account ongoing trends or anticipated events judged to be reasonably discernible. The planning horizon should be flexible, with short horizons in some cases and longer horizons in others. Normally, the second decade hence shall represent the period upon which future management practices shall be based.

IV. TIMBER MANAGEMENT PLANNING POLICIES AND THEIR IMPLEMENTATION

The plan was developed in accordance with BLM policy and procedures and within the framework of the Bureau's planning system, BLM Manual 1601-1603.

For comparative purposes, the five major planning policies and their implementation in the proposed plan are briefly described as follows:

1. Policy-Sustained Yield Level. Commercial forest land shall be managed under the principle of sustained yield. Sustained yield is defined as a policy which requires planning for a high-level and undiminishing output of wood. The sustained yield level shall include all merchantable wood material to be realized from the planned types of harvest.

   Implementation. Through the use of a computerized forest model, the recommended cutting level was computed based on a projection of the forest 400 years into the future. The coniferous wood volumes from the planned methods of harvest, in the form of commercial thinning and final harvest cutting was identified and in total provided for an undiminishing flow of wood over the 400 year projection period.

2. Policy - Size of Sustained Yield Areas. The size of the area for which an allowable cut is to be determined shall be such as to permit access to a sustained source of timber for each of its substantial markets or its clusters of communities within which conversion facilities are sufficiently varied to utilize the forest output. The Dillon SYU meets this standard.

feasible. Fertilization was not considered at this time on the basis of its possible detrimental effects on water quality which need further investigation. Forest genetics (tree improvement) was considered but dropped at this time because this program was not expected to be a common management practice during the planning horizon. Planting may be instituted to reforest unstocked acreage. Approximately 2,100 acres were classified as non-stocked in the 1973 inventory. A survey in the summer of 1977 shows 800 acres which need planting on the Dillon Resource Area. Jefferson and Broadwater Counties have not yet been surveyed. Precommercial thinning alone was not feasible but may become so within the planning horizon at which time adjustments in the computer run can be made. Precommercial thinning followed by commercial thinning and commercial thinning alone were found to be economically feasible and were included in the proposed timber management plan. While no major developments or innovations beyond the 20 year planning horizon were assumed, the practices forecast to be operational by this time were considered as ongoing programs thereafter. Consequently, the effect of these practices on the future productivity of the forest, along with improved tree utilization, are reflected in the proposed plan.

Implementation. The commercial forest lands shall be managed on a sawlog objective in consideration of the industry's demands for wood products as forecasted for the foreseeable future. Consistent with this objective, the International 1/8" log rule was selected as a relatively accurate measure of forest productivity in order to provide for the highest sustainable level of potential lumber production. The allowable cut, computed in International 1/8" board feet, was converted to Scribner board feet for the first decade for operation purposes. In light of current trends in improved tree utilization, the minimum merchantable diameters were set at 9" DBH for ponderosa pine, Douglas fir, alpine fir, and Englemann spruce with a variable top in measuring lumber recovery. Minimum DBH for lodgepole pine was set at 7" DBH with a 6 inch fixed top. Cutting levels do not include volume removed in smaller products (corral rails, fence posts) and salvage of dead trees. These products are below existing merchantable limits and fall into a pre-commercial category. The planning horizon of 20 years was used as a basis for identifying and evaluating intensive management practices such as precommercial and commercial thinning and rejecting such practices as forest genetics as being unable to make a significant contribution within the planning horizon.

5. Policy - Environmental Feasibility and Economic Analysis. Silvicultural practices shall be analyzed on the basis of their environmental and economic feasibility. Furthermore, the influence of present and planned silvicultural and utilization practices on the productivity of the forest shall be reflected in the allowable cut.

   Implementation. Four intensive management practices for a variety of site and stand conditions were analyzed to determine their economic feasibility and relative ranking. They included intensive reforestation, precommercial thinning, commercial thinning, and stand conversion. As a result of the economic analysis, the stand conversion practice was dropped because it was not economically

All of the volume figures in Table 1 would have been higher if other multiple use values and environmental protection needs were ignored. However, this is not the case in this plan. Approximately one-half of the potential biological yield from commercial forest lands is foregone in order to protect and enhance other resources. With periodic evaluation at a minimum of 10 year intervals, the base acreage is certain to change to some degree, resulting in changes in acreage and volume subject to harvest.

V. RESOURCE OUTPUTS FROM THE PROPOSED TIMBER MANAGEMENT PLAN

The timber management plan has a great influence on the production of other forest uses and values. In turn, as discussed in the previous section, multiple use considerations affect the cut. The following table presents the new allowable cut by harvest components.

TABLE 3

TIMBER OUTPUT UNDER NEW TIMBER MANAGEMENT PLAN

(Ave./Decade for first 20 decades)

HARVEST DISTRIBUTION	VOLUME (INT)	CUTTING PRACTICE	ACRES
Final Harvest	13.928 MM	Clear Cut	1,400
Final Harvest	32.060 MM	Initial Partial Cut	4,472
Final Harvest	11.215 MM	Intermediate Partial Cut	5,378
Final Harvest	25.940 MM	Final Partial Cut	5,658
Commercial Thinning	11.86 MM	Thinnings	4,680
Total	95.003		21,588
	Minus 18.58% multiple use factor		
	77.370 MM International log scale		
	*54.608 MM Scribner log rule		

The volumes are the results of applying the proposed timber management policies described in the preceding section to the new forest inventory completed by BLM in 1974 and recomputed in 1977.

Differences between these volumes and the allowable and programmed cuts now in effect will be discussed in the next section. At this time, it is important to note only the total volume of the cut and its major harvest components. These outputs are for the first decade only. Out of a total allowable cut level of 77.37 million board feet/decade (International 1/8), 9.3 million board feet or approximately 12 percent of the total cut is attributable to intensive management.

VI. FLEXIBILITY FOR FUTURE ADJUSTMENTS

The BLM timber management planning policies and procedures call for the reinventory of forest lands and recalculations of allowable cut every 10 years. Furthermore, the policies and procedures permit a recalculation of the cut at any time within each decade if any significant events warrant a recalculation. Such events could be losses through catastrophes, evidence of failures or shortcomings in practices adopted, funds or staffing insufficient to make management investments on schedule, development of new technology or research findings that permit introduction of new practices, and changes in land use classification.

Thus, a new timber management plan is not irreversible or rigid. If it should be proven too optimistic, it can be trimmed back at any time. If new information develops or better techniques are found to increase production, these can be entered into the computer program and the plan updated.

During the 1974-1984 decade, there may be several modifications to deal with such as recent changes due to wilderness review.

The current multiple use impact adjustments and exclusions from the allowable cut are based primarily on completed land use plans. If these plans are revised during the decade and significant changes do occur, the cut can be recomputed as such decisions are reached.

VII. PROGRAM REQUIREMENTS FOR THE TIMBER MANAGEMENT PLAN

An analysis of the manpower and funding requirements necessary to implement the timber management plan for the Dillon SYU shows that such a plan could be initiated within three to five years if sufficient funds and skilled people are made available to carry out facets of this plan.

It should be noted that both forest management and support type personnel are needed to carry out the program. Sufficient additional positions, man months, and funds are needed to do the following:

a. Increased volume and numbers of sales are necessary in addition to the increased requirements of planning and environmental concerns.

b. The timber management plan is very comprehensive in that it provides for timber production reconciled with multiple use and environmental requirements. Intensive multi-resource planning and administration are essential inputs.

c. Productivity of timber sale planning and preparation will be lower in the portion of the commercial forest land base within restricted cutting areas such as scenic corridors. Intensive planning is essential.

d. Cadastral survey support to set or remonument corners controlling public lands.

e. The plan will necessitate the need for an accelerated survey, design, easement acquisition, and construction of access roads.

f. A program of intensive management practices is essential to implementation of the plan. This will also include an increase in the insect and disease control (9700) activity.

VIII. RESULTS OF ECONOMIC ANALYSIS

An investment analysis of intensive management practices was run by the Denver Service Center Forestry Staff in February 1977. Following are the results of that analysis:

Basic Assumptions:

1. Stumpage values - $35.00/M bd.ft.
2. Utilization standards
   - Lodgepole pine 6" DBH, 4" top - 100 yr. harvest age
   - Douglas fir 11" DBH/variable top - 120 yr. harvest age
   - Douglas fir 6" DBH/4" top - 100 yr. harvest age
3. Estimate cost/acre thinning = $60.00
4. All benefit/cost ratios figured for 6 3/8% interest rate.
5. Planting costs - $95.00/acre
6. All runs for 100 year rotation age (RA) unless otherwise noted.
7. Cost of putting up timber sale = $12.00/M bd. ft.

Results:

I. Precommercial Thinning - Age 20 with stagnated stands

SITE INDEX			REFORESTATION	B/C		
PP	LPP	DF		PP	LPP	DF
30	--	30	No	1.02	--	0.92
40	40	40	No	1.16	1.09	1.07

Break even point for lodgepole pine is at SI 38

Break even point for Douglas fir is at SI 37

Break even point for ponderosa pine is at SI 29

II. Precommercial and Commercial Combined - Ages 20, 40, 60, 80 including stagnated stands

SITE INDEX		REFORESTATION	B/C	
LPP	DF		LPP	DF
50	50	No	1.17	0.76 (DF RA = 120 yrs)
50	50	No	--	0.74 (DF RA = 100 yrs)

This alternative only applicable on SI 50+ lodgepole pine stands.

Without Stagnated Stands

SITE INDEX		REFORESTATION	B/C	
LPP	DF		LPP	DF
40	--	No	0.86	--

This alternative would not be practical as B/C ratios for most stands would be lower than those listed above.

III. Commercial Thin - Age 40-70 including stagnated stands

SITE INDEX		REFORESTATION	B/C	
LPP	DF		LPP	DF
30	30	No	0.97	0.89
--	40	No	--	2.10
50	--	No	1.12	--

Break even point for lodgepole pine is at SI 30

Break even point for Douglas fir is at SI 32

Without Stagnated Stands

SITE INDEX		REFORESTATION	B/C	
LPP	DF		LPP	DF
	30	Yes		0.77

Thinning in stands which are not stagnated has a negative B/C ratio.

IV. Commercial Thin - Age 30-50-70 including stagnated stands

SITE INDEX		REFORESTATION	B/C	
LPP	DF		LPP	DF
	30	No		0.57
40		No	1.03	
40		Yes	0.85	
	30	Yes		0.51
50	50	No	1.25	0.87
50		Yes	1.00	

Break even point for lodgepole pine is at SI 39 without regeneration and SI 50 with regeneration. This treatment does not pay in Douglas fir.

Without Stagnated Stands

SITE INDEX		REFORESTATION	B/C	
LPP	DF		LPP	DF
40		Yes	0.85	
40		No	1.03	
50		Yes	1.00	

Break even point for lodgepole pine is at SI 39 without reforestation and SI 50 with.

The benefit/cost ratios are computed in this study from strictly silvicultural costs and benefits. No spinoff benefits were figured in such as wildlife forage, grazing, etc.

IX. RECOMMENDATION AND APPROVAL

This plan lists fourteen (14) alternatives for timber production on public lands in the Dillon SYU. I hereby recommend that Alternative #14, which plans for a sustained harvest of 54.6 MMBF Scribner Log Rule per decade, be adopted, provided that sufficient manpower and funding is made available on a continuing basis to carry out this plan.

Reviewed by ______________________________ ____________________
Dillon Area Manager Date

Reviewed by ______________________________ ____________________
Headwaters Area Manager Date

Recommended by ______________________________ ____________________
District Manager, Butte Date

Approved by ______________________________ ____________________
State Director, Montana Date

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